PACIFIC DISCOVERY

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PACIFIC DISCOVERY

Editor and Art Director: DON GREAME KELLEY; *Managing Editor:* ROBERT C. MILLER; *Associate Editors;* IRA L. WIGGINS *(Stanford University),* A. STARKER LEOPOLD *(University of California);* VERONICA J. SEXTON, BENJAMIN DRAPER, ROBERT T. ORR, ALLYN G. SMITH *(California Academy of Sciences); Special Correspondent:* THANE RINEY *(Wellington, New Zealand)*
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PRE-DISCOVERY

AMBER: our stories of new discoveries of fossil-bearing amber, announced for this issue, will appear in the next – certain problems with illustrations made the shift necessary. The presentation will be even more interesting, we are sure, as a result of the otherwise regrettable postponement.

WILDERNESS: "Let's Save Some–" will be the theme of the Fifth Biennial Wilderness Conference to be held March 15-16, 1957, at the Fairmont Hotel in San Francisco, under the chairmanship of George L. Collins of the National Park Service. The Sierra Club is chief sponsor of the conference; others include the Wilderness Society and the American Planning and Civic Association, two national organizations with Washington, D.C., headquarters. Behind the conference is an organizational membership of more than 10,000 conservation-minded citizens. From a recent release we learn that "Our Scenic Open Space Resources" will be the first-day subject; "a national wilderness preservation system" will be discussed on the second day. "All persons interested in preservation of wild and wilderness areas for the enjoyment of present and future generations are invited to attend and participate in the Conference. Only a $2 registration will be charged" (which doesn't include the Friday night banquet, of course).

MR FRANKLIN: *A Selection From His Personal Letters* is the title of a specially handsome commemorative volume which reached us just too late for mention in our editorial essays last year taking note of the 250th anniversary of Benjamin Franklin's birth. So many different trade and professional groups claim Mr. Franklin as a sort of patron saint – especially printers and scientists – that Carl Van Doren's description of him as "a harmonious human multitude" has double weight even though referring to Franklin's own astonishing variety of interests and achievements. The letters here presented, in format which would have delighted Franklin the printer, include several which illuminate Franklin the scientist. (Edited by Leonard W. Labaree and Whitfield J. Bell, Jr.; Yale University Press, New Haven; Geoffrey Cumberlege, Oxford University Press, London. 1956. xxii + 61 pp., 6 color plates. $3.75.)

PD'S AUTHORS

OUR CONSERVATION editor A. Starker Leopold was instrumental in bringing to *PD's* pages **Carleton Ray,** his former student, and **Elgin Ciampi.** Now Ph.D. candidates at Columbia University (Ray in zoölogy, Ciampi in psychology), these two underwater explorers are known for their book *The Underwater Guide to Marine Life.* . . . ¶From Twentynine Palms, **Lucile and Harold O. Weight** roam the deserts of California and the southwest in search of ghost towns and other haunts of human and natural history. *PD* readers have already enjoyed Harold's "Las Tinajas Altas" and "Valley of Fabled Death" (1952) and their joint contribution of desert tree photographs last spring. . . . ¶Also well known to our readers is **Weldon F. Heald** who operates with typewriter and camera out of Tucson, Arizona, he and his wife Phyllis W. Heald making another team of desert and wilderness explorers. . . . ¶Now of Providence, Rhode Island, **Blackmer Humphrey** took the Redrock Canyon photos on an assignment out of Los Angeles some few years ago and has waited patiently for us to find an article. He and *PD* have been well rewarded in finding an author who knows the place like his own back yard: **A. O. Woodford,** professor of geology emeritus at Pomona College, Claremont, California, whose "principal interest is petrology, especially the study of southern California and Baja California rocks." ¶Here with his third *PD* whale story is **Dr. Raymond M. Gilmore,** Fish and Wildlife Service biologist at Scripps Institution of Oceanography, La Jolla, California. . . . ¶**Weldon D. Woodson** is a widely known writer-naturalist who makes his home in Alhambra, California. He has previously written for *PD* on tortoises and tarantulas. D.G.K.

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THE COVER

FOUR-EYED BUTTERFLY FISH *(Chaetodon capistratus)* is found from the West Indies, where it is common, to Florida and straggling to Cape Cod. It grows to 6 inches. Photo by Elgin Ciampi *(see pages 1-3).*

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EDITORIAL

Taking Conservation Underwater

Carleton Ray

Gene Ciampi

THROUGHOUT HISTORY THE SEA has remained the least known part of the world. When man first began to sail the open ocean in search of food and wealth, he was awed by its endlessness. In places, he came upon great numbers of fish, and this gave him the feeling that the riches of the sea, like its bounds, were indeed endless.

Man has increased his numbers, his technical ability to reap greater harvest from the sea, and his per capita use of these resources, but the feeling of inexhaustibility remains. He still wants to believe that resources and human ingenuity in using them both have no limits.

Yet experience has proved that oceanic resources are, like those of the land, exhaustible; and although there is much still to be learned about the sea and its life we know now that the precepts of conservation must be applied to the waters as well as to the lands of this planet. Despite vastly improved fishing methods the world catch of many food fishes is decreasing, in direct consequence of depleted supply. Salmon, shad, and California sardines are examples of important commercial fishes losing ground under the impact of overfishing. International treaties limiting the catch have stemmed the decrease of some fishes like the Pacific halibut, and of several pelagic mammals like the gray whale, elephant seal, and sea otter; but the job of establishing a firm conservation policy for the resources of the ocean lies mostly ahead.

Along the shorelines of the sea man has devised a new way of reaching and using its natural wealth. Clad in goggles, a breathing device, and fins, he is going underwater personally to explore and exploit. With underwater spears and guns he can stalk and kill the larger fishes. With various tools he can capture or dislodge edible invertebrates of the sea bottom – shellfishes, lobsters, squids. He has found this occupation so rewarding, and at the same time such fun, that skin diving has become an enormously popular pastime in the few years since it started on the shores of the Mediterranean.

Spear-fishing already has taken telling effect on offshore resources. There are waters of France, Italy, California, Florida, and Mexico where the larger fishes are sorely depleted by overhunting and the survivors are frightened and wary. The more accessible shellfishes and lobsters have been harvested and one must go to greater depths or to newer shores even to see them. Exquisitely beautiful underwater gardens of coral and gorgonians have been plucked for souvenirs until their beauty is gone. If the fine sport of skin diving is to remain popular and rewarding, conservation plans must be devised for offshore areas to parallel those for open waters and the land itself.

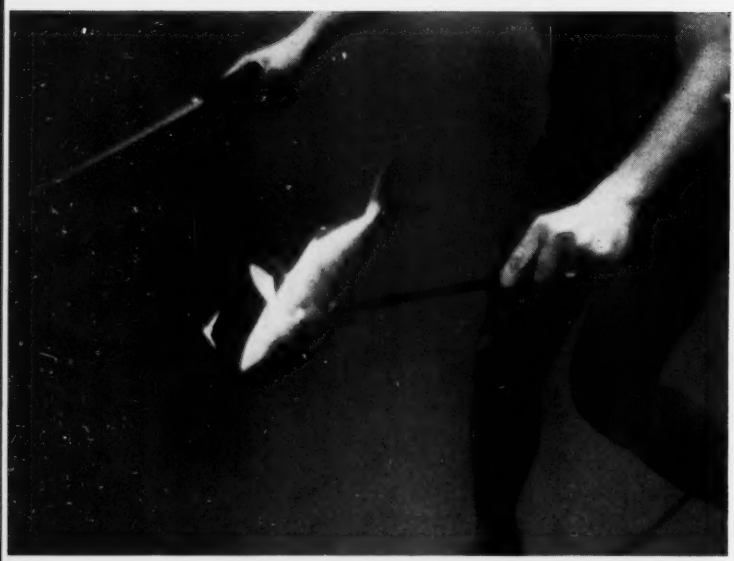
Many government agencies are beginning to give serious thought to the problem of regulating spear-fishing; but perhaps the most advanced planning in progress has been undertaken in the Bahama Islands where some of the world's most extensive and most beautiful coral gardens are found. There life piles on life in a continuous and immensely prolific complexity. The Bahamas government, fortunately, is not only aware of present and increasing dangers but is doing something about them. It knows the pressure of spear-fishing is bound to flow south and east from Florida, California, and other places in the United States as those areas become more and more depleted. It also realizes that divers are not the only users of the sea. In terms of fishing out an area, it makes no difference whether a man goes underwater and spears twenty fish, or the same man hooks twenty from the surface. The loss is the same and it would be unjust to restrict one kind of fishing and not the other. Excesses are bad in either sport. Any effective conservation program must be aware of all marine activities – the Bahamas Plan is concerned with the whole productivity of the sea.

The Bahamas Plan applies to the sea the same principles of conservation that have been evolved for land use over the last fifty years. It has two fundamental parts:

One: underwater parks. As a first step, some of the richest areas would be set aside as a series of underwater parks after the manner of true wilderness areas on land. No marine life – animal or plant – could be taken by any means. Parks would be open to photographers, naturalists, and all whose interests are either esthetic or scientific, for skin diving or surface viewing. The advantages to be derived from underwater parks are the same as from those on land. Marine parks would serve as sanctuaries for both rare and common species and would be areas of replenishment from which life could spread into surrounding non-protected regions, assuring a constant supply. Parks also preserve the natural, virgin beauty of the wilderness as a source of unending inspiration. Science and

NOTE: The authors' book, *The Underwater Guide to Marine Life* (Barnes, New York, 1956) is reviewed on p. 30.

Erratum: for *Gene* read *Elgin Ciampi*



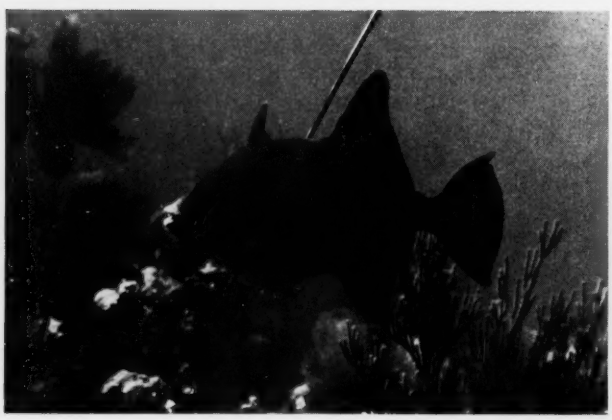
education would be stimulated by having available such natural study areas free from the danger of destruction.

Two: regulation of spear-fishing. The second part of the Bahamas Plan entails sponsoring conservation programs for spear-fishing and other sporting and commercial marine activities. Exactly the same sort of rules we have for land animals should be applied to the sea — the recognition of game and non-game species; size and season limits for game and commercial species; a legislative method of bringing offenders to book (with funds derived being put into enforcement and development); prohibition of spearing with the aid of aqualungs in shallow water; and the imposing of limits on shell collecting and coral destruction. The complexities are great in this part of the plan.

« Shall we have unlimited trophy-hunting . . .

. . . or unspoiled beauty in the sea? »

We can't have both . . . for long . . .

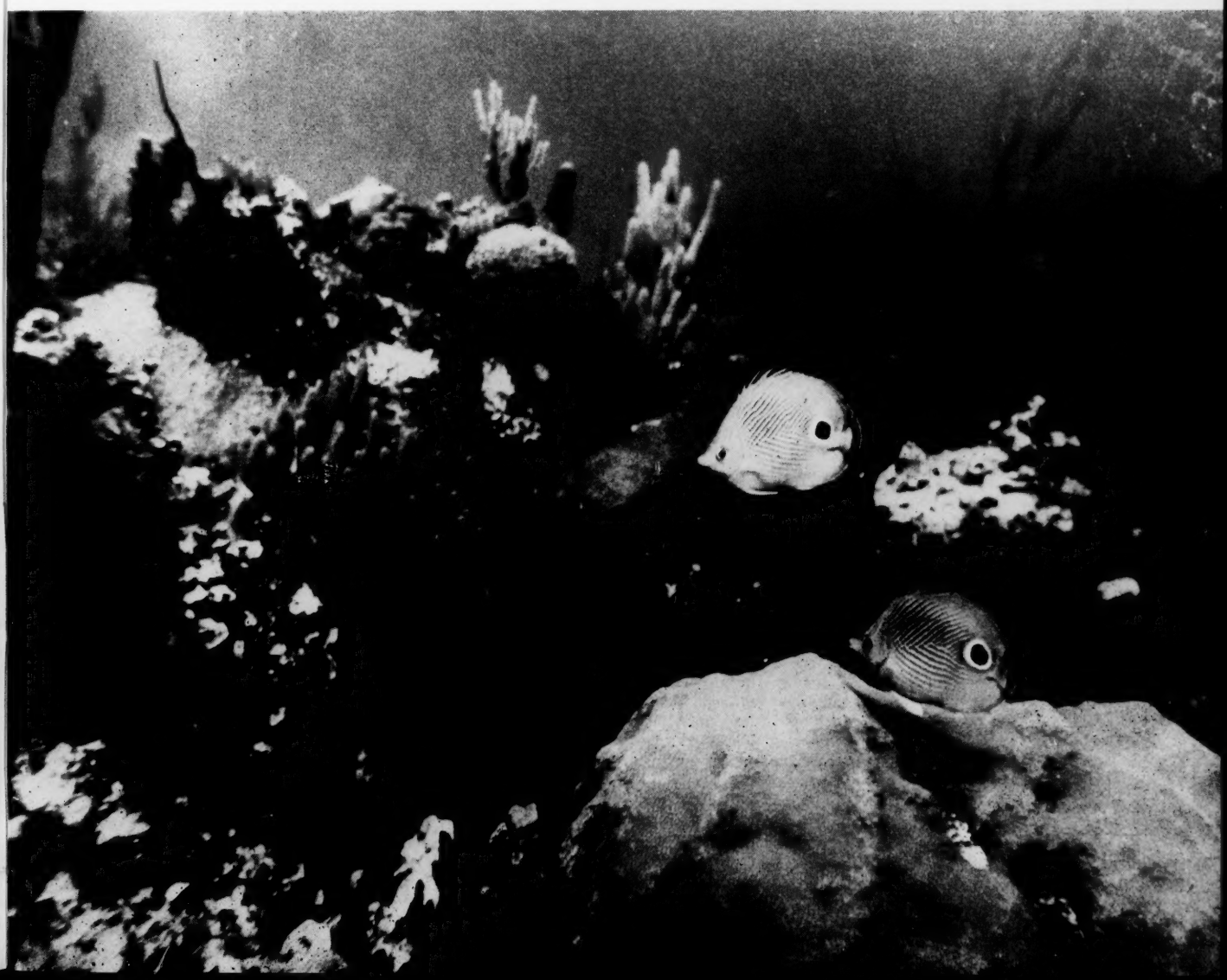


2 ➔ Brain coral grows like a huge mushroom from the coral reef and is usually decorated by a swarm of little fish swimming over its crest.

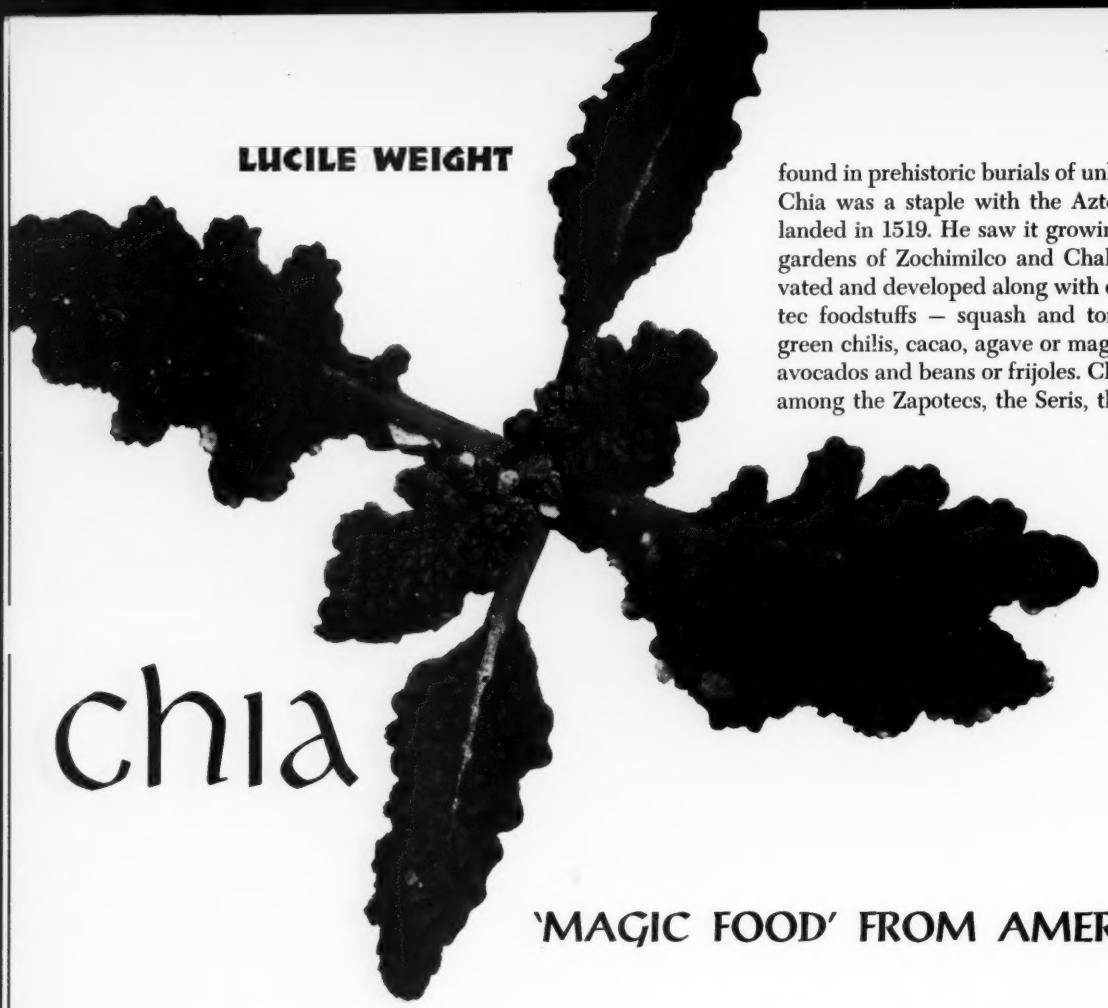
An aware and flexible approach will solve most of the problems. Responsible wildlife managers, professional conservationists, and fishing and diving organizations would have to be consulted. Fish and game offices would have to be established or marine divisions expanded. But it seems logical that by regulating the take, a healthy, productive resource could be maintained for the enjoyment of future generations of skin divers.

The precepts of the Bahamas Plan will doubtless be adopted in one form or another wherever skin diving is practiced. Certainly in the newly-invaded offshore waters we have a chance to apply the lessons of conservation learned so painstakingly on land and in the open sea. The wonders and beauty of the sea bottom should be preserved for all to enjoy.

A cluster of pink fan worms protrudes from tubes in stone coral. They will withdraw quickly at the mere passing of a shadow.



LUCILE WEIGHT



chia

'MAGIC FOOD' FROM AMERICA'S PAST

IT WAS NOT THE TRADITIONAL WAY to harvest chia – but I didn't have a seed beater. Even if I had owned one of those tennis racket affairs, I lacked the skill with which Indian women once flailed the tiny seeds into their wide tray-baskets. So as I broke off the foot-long stems, I carefully stowed them into a paper sack to take to my desert kitchen.

For contrary to their rusty dry appearance, these stems are no ordinary weeds. Rather, they are magic wands whose whorls are loaded with seeds so sustaining that a minute quantity will fortify an active man for a whole day,* and these nuggets of nutrition are as rich in fascinating history.

Chia's potent properties were discovered in the dawn of our Western world. The seeds have been found in prehistoric burials of unknown antiquity. Chia was a staple with the Aztecs when Cortés landed in 1519. He saw it growing in the floating gardens of Zochimilco and Chalco. It was cultivated and developed along with other famous Aztec foodstuffs – squash and tomatoes, red and green chilis, cacao, agave or maguey, maize corn, avocados and beans or frijoles. Chia was observed among the Zapotecs, the Seris, the Tarahumares, and other native Mexican tribes. While the more sedentary Indians cultivated it, nomadic and desert Indians, almost to the present time, have gathered it wild over a great area from Mexico through our Southwest into northern California.

The seeds I was harvesting, on a July day in the southern Mojave desert of California, were those of *Salvia columbariae,* the species most commonly called chia. Under a magnifying glass they appear mottled and a glistening gray-brown, much like some bird eggs, but flattish on one side, with a ridge on the opposite. One of the smallest of the sages, this chia is found in much of California, southern Nevada and Utah, and in Arizona, especially the foothill and mesa country. I have seen it equally at home along the Pacific shore at San Diego, in the chaparral and on desert slopes. From sea level it climbs to 7,000 feet, but more commonly it is below 3,500 feet. Chia seeds may be found ripe at any time from late April through August,

*"One tablespoonful of these seeds was sufficient to sustain for twenty-four hours an Indian on a forced march."– Dr. Cephas L. Bard of Ventura, as quoted in Parsons, *The Wild Flowers of California.* (California Academy of Sciences, San Francisco).

A chia plant *(Salvia columbariae)* begins to spread its rosette of sage-green crinkled leaves on coarse desert sand. After the flower stem rises from this base the leaves dry and curl and "rust" away. This member of the mint family is an annual. Its leaves range from one to several inches long, depending on moisture, exposure, and other varying conditions of growth.

depending on elevation and the season's rainfall. Chia blossoming varies from March through May.

Rising from a flat rosette of crinkled sage-green leaves, the stiff little stem, four or five inches to perhaps 18, is ornamented with a series of sapphire studded whorls. The inconspicuous blossoms, with exquisite mint-flower forms, are worth a close look. Some botanists call them "blue" or "purple" but they vary from sky to pale pastel blue and even lilac mottled with deeper tons of blue or violet. Also occasionally called chia are thistle sage *(Salvia carduacea)*, which is scattered in California, and some other species reaching into interior Mexico.

Chia was both a staple and an important component of *pinole*, the trail food par excellence. Compact and condensed, chia pinole was the standby of Indian runners and traders over thou-

Often chia grows stiffly erect, the flower-studded whorls clasping a single stem, but with good rainfall or the encouragement of a protecting shrub it may have several branches and assume a more graceful pose. Seeds are now developing in this specimen; only a few flowers remain. (Nearly twice enlarged.)

PHOTOS BY HAROLD O. WEIGHT

"After the blossoms have passed away, the dried heads and stems remain standing all over the hills, shaking out the little gray seed in abundance" (Parsons).

substitute equal to chia, we have not found it in historical accounts. While corn was much used for pinole, it was not available over as widespread an area, and its greater bulk was a drawback.

Chia on the other hand is comparable to some of today's scientifically concentrated camp foods. But even here chia, parched and ground into pinole, is superior. Water is not essential with chia. It can be, and often was, eaten dry in its ground form. An Indian thus equipped would never have found himself in the predicament of a white explorer we know. Forced to make a dry camp after missing his scheduled stop, he also missed his supper and his breakfast. In his commissary was a tempting array of dried foods, but with no water to prepare them, they were inedible. He went hungry surrounded by his "emergency" food. If an Indian had chanced along, the two might have shared a little pouch of chia pinole. This, with a swallow from his canteen, would have prevented his lying awake, each hunger pang calling forth maledictions upon his misguided guide.

When Cortés had conquered Mexico and the

sands of miles of desert and mountain trails. If it had not been for this magic trail food, intercourse among the native tribes would have been more difficult. What effect this would have had on the conquests of Western America can be but dimly surmised. With "supply stations" often so far apart that even the resourceful Indian could not depend upon them, some such provender was necessary for fast and distant foot travel. And if there is a

Spaniards started their northward expeditions, they found chia in use by the Pueblo tribes of our Southwest. Even one of the New Mexican pueblos, now called Zia, they spelled "Chia." While Coronado was pursuing the golden shadow of Cíbola somewhere east of the Colorado, Alarcón was trying to get supplies to him by the river route. When he finally reached the territory of the Yumas, one of the things which impressed him — in 1540 — was a seed they carried, which might have been chia. He wrote: "They wear also a sort of bag a span long, tied to their left arm, used as an arm band for the bow, filled with some seed from which they make a kind of beverage."

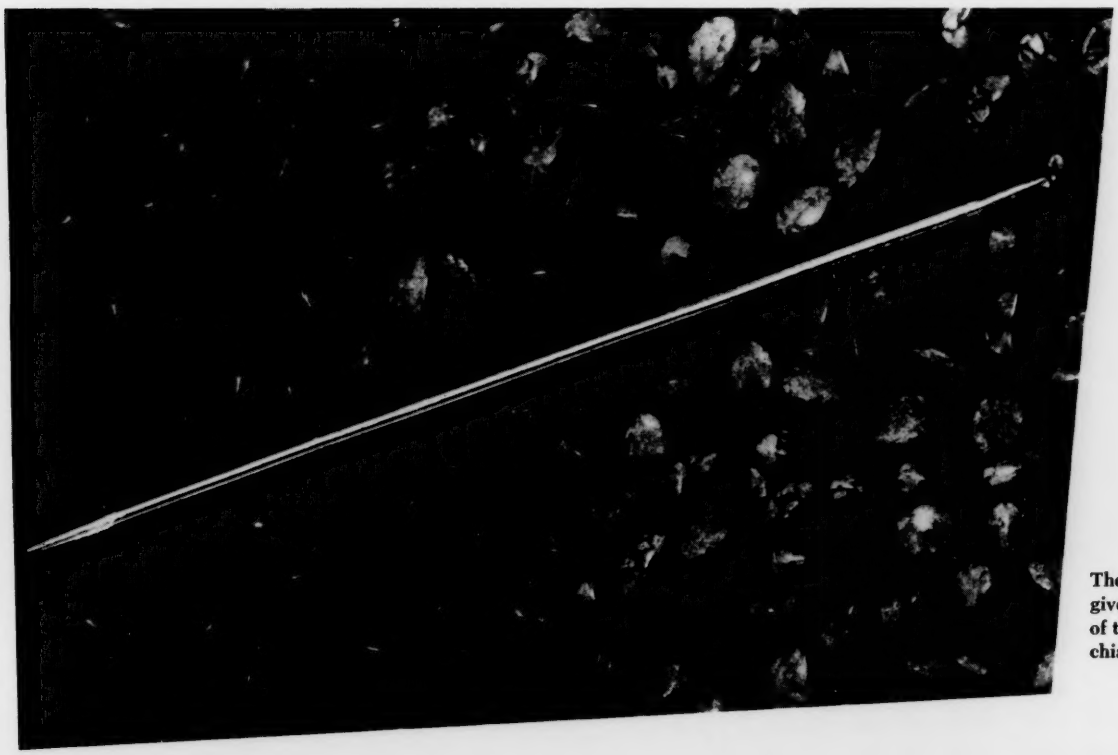
Two years later, 175 miles to the west, fellow-explorer Cabrillo sailed into San Diego Bay. As he stepped onto the sandy shore of Point Loma on a bright September day, the local inhabitants propitiated their first white guest with an offering identified as chia.

While chia was mentioned in the earliest Spanish reports, it took its place in standard literature in 1571. That year Alonso de Molina's vocabulary, published in Mexico, defined a mixture of parched and ground maize and chia as *pinolli* and *pinolatl,* the former in the dry state, the latter mixed with water as a gruel.

When the Jesuits and Dominicans and Franciscans, in the 17th and 18th centuries, pursued their labors northward and beyond our present Southwest border, most of them had to live off the land — and chia must have been a soothing foil to the fire of chili which made some of the padres erupt in warm prose. The great Franciscan, Garcés, who spent much time on side trips while accompanying Captain Juan De Anza on his colonizing expedition to Alta California from mainland Mexico in 1776, subsisted almost entirely on native fare, and he does not overlook mentioning chia. A few years before, members of Portolá's pioneer expedition into Alta California observed the natives parching the seeds by tossing them about with hot coals in a flat basket.

In 1792, with more than half the California missions built, the first Spanish naturalist surveyed the Californias, reported on natural products and sent collections to Carlos III in Madrid. José Longinos Martinez observed that seeds of the sages were the most commonly used in pinoles, listing them even before acorns and pine nuts. With his third package to the King of Spain, he wrote out a manifest which included: "Salvia Chia (called chia), one of the seeds which the gentiles of California collect in abundance for food; it is very mucilaginous; the Mexicans make a beverage of it, of the same name of chia, which they esteem and sell publicly like the best refreshment."

Chia also was part of that gracious living, romanticized by generations of writers who told of rancho life in *California de antes.* Often the after-



The common pin gives a good idea of the size of chia seeds.

Government engineers exploring for the first Western railroads in 1854 found the Mojave Indians near the Colorado River building granaries for their crops and making large storage ollas for wild seeds, including chia. (Engraving from "Report on the Indian Tribes" in *Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean*, volume III, Washington, 1855)

noon "tea" or *la merienda* featured chia. But this was chia with an elegance.

When the first summer days brought a drowse upon the land, Indian servants gathered chia from the golden pastures and the flowered mesas; they threshed out the little seeds and parched them. Now they were ready to brew fragrant "tea" as the dark eyed señoras and señoritas gathered in shaded patios or on cool verandas. The caballeros would swing up to the gate on spirited horses, and the collation would be spread.

. . . Now steep the little chias in boiling water –

Early Spaniards in New Mexico reported that Indians of Zuñi Pueblo used chia. This view shows Zuñi's main plaza as it appeared in the 1880's. Zuñi is considered to be representative of Coronado's "Seven Cities of Cíbola" that lured the Conquistadores into the desert in 1540. (Maude, from Southwest Museum collection)

that fragrance arises from the orange flowers in the pot . . . and will you have an *azucarillo de limón*? just a crystal of sugar dipped in lemon, for zest to the chia? . . . ah! *fragante, delicioso, refrescante!* . . . and now to pass the *polvorones* – the tea cakes – or we'll have here a *buñuelo* or – better – a *borrachito* made with *vino*. Another cup of chia – and then a *dulce*, a preserve of nopal or quince . . .

Side by side with this refinement of use, chia remained a staple rather than a luxury with the Indians of the Californias, so important that in dry years battles were fought over stands of it. One such struggle took place on the rolling hills between Palomar Mountain and San Jacinto, when one band, bereft of chia that year, invaded the traditional fields of a more fortunate tribe. And stories have come out of Baja California of similar battles in remote mountain valleys.

Through the mountains and across the desert lands of southern California and Arizona there still are networks of Indian trails. These are ancient ways, yet they were used by Indians even after Americans rushed to the gold fields. The earliest mountain men and scouts, in the 1820's and before, followed many of them, and met Indian runners along the way. Rarely was the tribesman without his little pouch of pinole. It consisted of whatever his squaw could gather. She might add wild rice or grass seeds to the chia, or a bit of corn or wheat, all ground on her metate with deft strokes of the stone mano. If the Indian reached a *tinaja* or *pozo*, he could add water to a little of his pinole for a refreshing and sustaining gruel.

Two Americans crossing the Colorado Desert on such a trail in September 1862, headed for La Paz gold placers, were stranded without food. They had reason to rejoice at the arrival of a squaw man from mountains 100 miles to the west, who was generous with pinole his squaw had ground. "The pinole we consumed and were accustomed to was made of parched corn, ground to a coarse powder; but that which our rescuer brought was of certain grass seeds gathered by squaws and pulverized. To us it was first rate diet . . ."

More than thirty years after this encounter, in the 1890's, the late Dr. David Prescott Barrows was making a study of Indian foods among the Cahuillas, which was published by the University of Chicago Press as *Ethno-Botany of the Coahuilla Indians of Southern California.** "Perhaps the most important of the seed foods used by the Indians is the justly famed 'chia,' . . . called by the Coahuillas *pá-sal*," Dr. Barrows wrote, then quotes Dr. Harvard: "'After careful roasting they are ground into meal, which, when thrown into water, expands to several times its bulk, the mucilage rapidly dissolving.'" The Coahuillas usually mixed chia with about three times as much wheat flour, when they had it, to make pinole – or as they called it, *to-at*. "It is an old and famous preparation." Usually a little sugar was mixed with it. "In this shape it is a much prized article of food with all who have become acquainted with its nutritive and reviving qualities. Experienced prospectors and desert travelers carry a little bag of it with them, and when the warm, alkali water holes are reached, a few teaspoonfuls of the pinole in a

*University of Chicago Press, 1900.

Inside a granite cave at Tinajas Altas (See *PD*, Jan.-Feb. 1952) along El Camino del Diablo in southwestern Arizona, I found mortars where a Sand Papago woman once sat grinding chia and other seeds.

quart cupful of the water seems to neutralize somewhat its dangerous qualities and make a refreshing drink more nourishing than gruel."

The Cahuillas sometimes baked pinole in little cakes or biscuits. "Either way chia is used, it is very good, has a pleasant, nutty flavor, and is exceedingly wholesome." In early summer, sixty years ago on Coachella Valley, which today is famed for its date groves and Palm Springs resorters, Dr. Barrows found in every Indian home the ollas being filled with chia seeds, as "throughout the cooler hours of the day and evening there is ever a woman grinding at her mill."

Twenty years later a visitor to this same desert country found little use then made of wild foods, of which chia was once the "great stand-by." But J. Smeaton Chase, writing of his 1918 trip in *California Desert Trails,* occasionally saw on "old housewifely crone seated on the ground and embracing with outstretched legs the wooden mortar in which she pounds out the family flour; or creeping about among the brush, beating with bat of palm-fibre the *chia* seeds into her bowl-basket."

The Indian has been crowded from his water holes. His trees have been cut down for white man's use and his wild pastures taken for white man's fields. Now he buys white man's flour and beans and coffee. But until very recent times, some families came back to ancestor-haunted desert camps to gather wild dates or mesquite beans or piñon nuts in nearby mountains – and chia seeds. One such mecca is Thousand Palms Canyon, now long the home of Paul Wilhelm, poet and writer of desert lore. During his first year at the oasis he subsisted as the Indians had before him on the bounty of the desert. Chia seeds he mixed with mesquite beans and wild buckwheat and thyme, grinding them on a stone he found at an ancient campsite and cooking them thin on hot stones, pouring over them wild honey. (Chia flowers themselves yield a fine white honey.) For a drink he mixed chia seeds with water and honey, pronouncing it healthful and "delightfully suggestive of cinnamon and lemon."

Forty-six years ago, Mary Beal, now a nationally known authority on Mojave Desert flora, began her desert life as an invalid on the old Van Dyke ranch on the Mojave River, through the efforts of John Burroughs and John Muir. Her later flower hunting trips into desert mountains were rugged. Seeing her slight figure weighed down with notebooks and camera equipment, Judge T. S. Van Dyke passed on a "going light" tip from his Indian friends. He declared he could walk farther on a few spoonsful of chia, which he collected for pinole, than on pounds of any other food. Mary ground her chia, mixed it with wheat germ and moistened it with just enough water to form dollar sized cakes half an inch thick. One of these cakes, with a few "bread dates," an orange or grapefruit and a lemon, comprised her food supply for a day's hard climb over rough boulders and through thorny undergrowth.

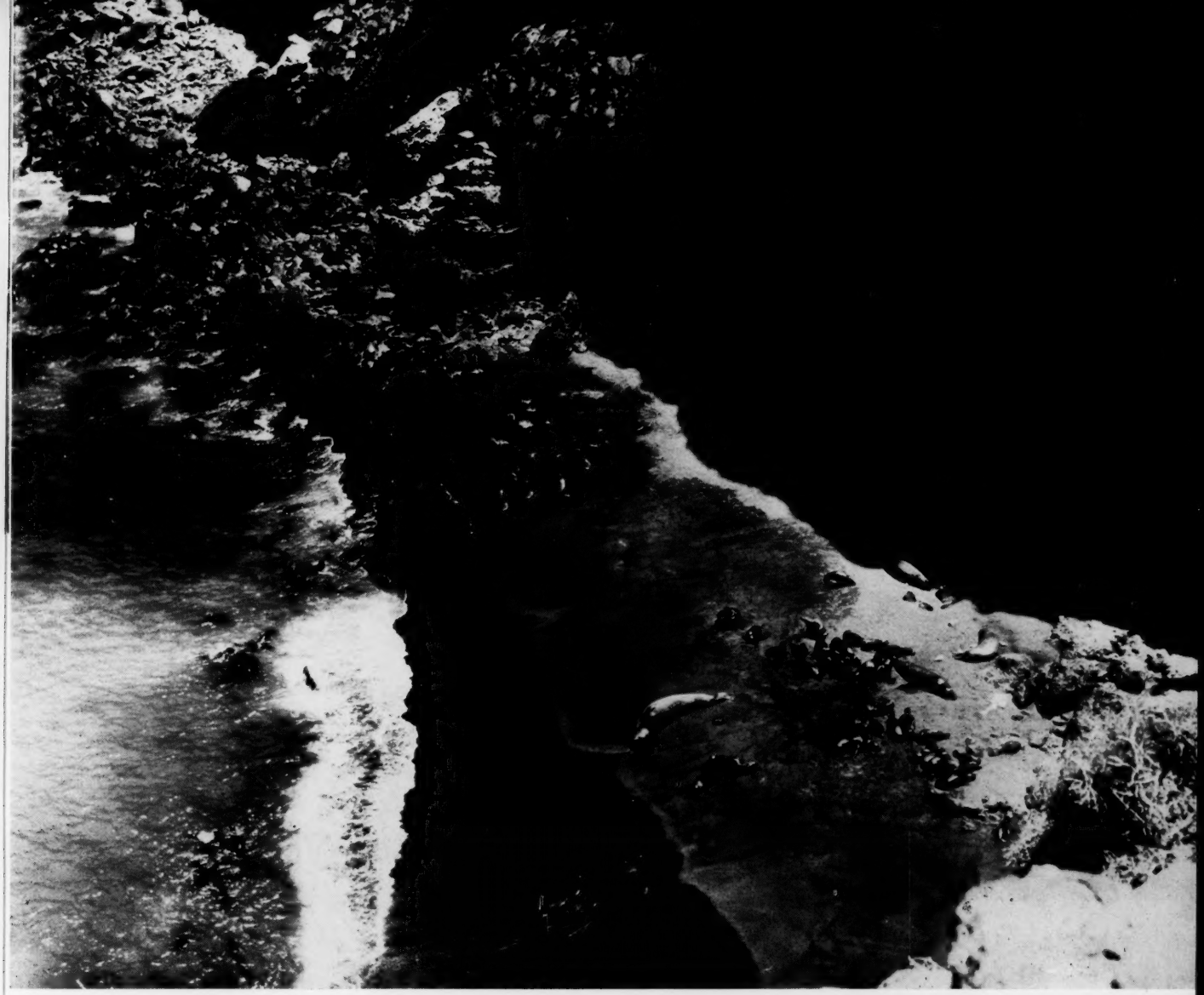
At stores, in the 1890's, chia brought six to eight dollars a pound. In 1910 it still was easily obtainable at southern California drugstores, where it was kept especially for Mexican customers who used it for both food and medicinal beverages and poultices. But recently a man wrote to 27 stores before finding one with a stock of chia seeds, priced at 75 cents a pound, minimum five pounds. The cost sometimes is higher than this, depending on the season and source of supply. Some of it, sold as far west as Tucson, comes from Texas.

If chia were more generally available today, it might be appreciated and relished as much as it was through the earlier centuries of our Western history.

Even though chia is difficult to find now, people widely scattered through the Southwest are using it. One desert hostess tops her hot rolls with chia seeds instead of poppy or sesame. Another serves a chia desert like an ambrosial gelatine – but it contains no gelatine. She adds a "judicious" amount of water to chia, enough lemon juice for tang, a little honey. After a few hours' chilling she has a dish that mystifies and delights every guest.

Developing my own chia delicacies, I've gone back to the Indian mill as the best seed grinder. I use a small black lava metate I found at the edge of a dry wash in a remote desert basin, and a white granite mano from another ancient camp many miles from water or present habitation. If a spirit haunts these stones, as I use them here by another desert oasis, I know it is a good spirit – a survival in time of the prayers of an Indian woman for her brave's good journey. . . .

And when I follow lonely trails across black desert mesas, sometimes it seems the mirage-quivered air half reveals shadowy forms ahead . . . there they go, a band of lithe and sun brown men, to trade with river tribes or to outwit the wild bighorn sheep – and each with his little skin pouch of chia, safeguard for the hungry miles.



Seagoing NATIONAL MONUMENT

Weldon F. Heald

CHANNEL ISLANDS National Monument is within view along miles of the southern California coast — but is one of the least known of the 176 units of our widespread National Park System. Most landlubbers have never heard of it; the few visitors are mostly yachtsmen, deep-sea fishermen, and an occasional party of campers. Yet it is a unique and fascinating area of rugged, austere beauty practically at our doorstep, and like no other national park or monument in the United States.

A presidential proclamation established the seagoing monument in 1938 to preserve the special scientific values—geological, biological—of Ana-

On Santa Barbara in the Channel Islands National Monument, seals and sea elephants hold this beach of the north shore. The four elephant seals in the picture may be distinguished by their larger size *(lower right).* (National Park Service photograph by Rose)

capa and Santa Barbara, smallest of the eight Channel Islands which lie offshore in the Pacific, south and west of Los Angeles. The monument's two parts total 42 square miles, almost every land and water feature holding something of uncommon interest.

Like the others of the Channel group, Anacapa and Santa Barbara are the summits of submerged mountain ranges once connected with the mainland—mountain-tops showing fine examples of ancient vulcanism, deposition, and sea erosion, and containing a wealth of fossils, from marine invertebrates to Pleistocene elephants and trees. In some places three distinct elevated beaches are clearly defined by terraces along the high cliffs. Both islands are honeycombed with caves gnawed out through centuries by the ceaseless surf. Of flowering plants native to them more than eighty are known; of animals and birds, thirty; sixteen kinds of land mollusks infest them. Anacapa has kitchen middens, shellmounds, and other evidence that Indians lived there. But perhaps the three most outstanding features of Channel Islands National Monument are the amazing numbers of nesting water birds; the numerous rookeries of

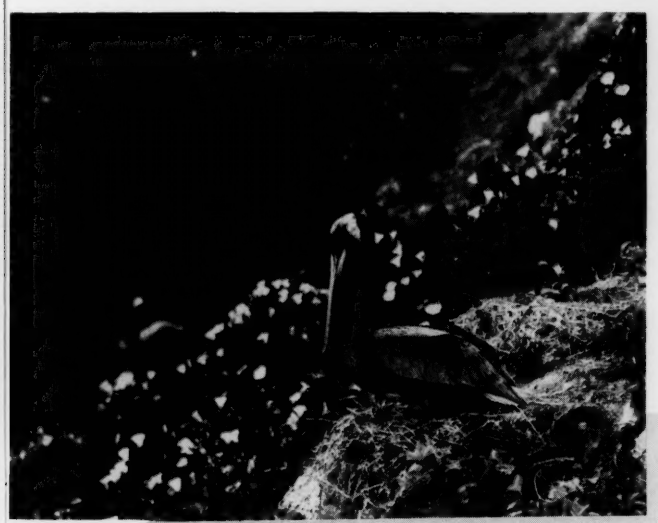
← The struggle of an ancient island plant, the giant coreopsis or "tree sunflower," to survive the domestic rabbit introduced apparently during World War II, is being aided in every feasible way by Park Service biologists. Their aim is to restore these islands as far as possible to their aboriginal state. This is the "Grizzly Giant" in 1950 and in 1954. (NPS photos)

Sea lions swim unafraid near the landing area on Santa Barbara. (NPS photo)

seals, sea lions, and sea elephants; and the teeming marine life along the shores and in the surrounding waters.

Anacapa is the most easterly of the four islands strung along in line south of the city of Santa Barbara, and is 12 miles from Point Hueneme, near Oxnard. Actually three small islands divided by narrow, shallow channels, Anacapa is 5.5 miles long all told, makes a half mile at its widest, and rears its west end 980 feet into the fog. The western and middle sections are uninhabited, but on the eastern island are the buildings of Anacapa Light Station, with the white, cylindrical lighthouse standing on the easternmost tip, 277 feet above the ocean. The lighthouse reservation is not a part of the national monument.

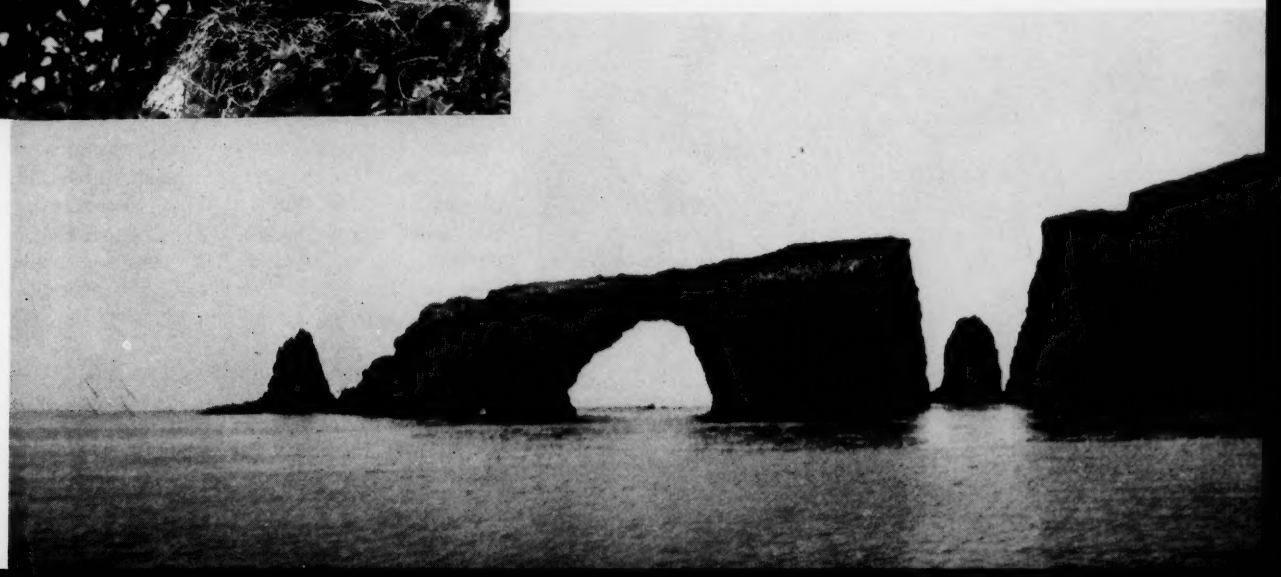
Abrupt slopes and almost perpendicular cliffs give fogbound, windswept Anacapa a barren, rugged look. A baffling thing is that it never shows the same face from two points of view—it has been called variously "Ever-changing" and "Deception" island. The eastern end presents a great tilted mesa supported by cliffs rising from the sea. Jutting out is an isolated section pierced by a huge arch over the water. Officially Arch Rock, this is



↑ Lush native vegetation on the West Anacapa bird refuge—untouched by rabbits. (National Park Service)

← Conspicuous in the Monument's large sea bird population is the California brown pelican (NPS photo) which nests

↓ in 2,000 pairs on Cabrillo Arches piercing the cliffs of Anacapa's eastern tip. (Weldon F. Heald)



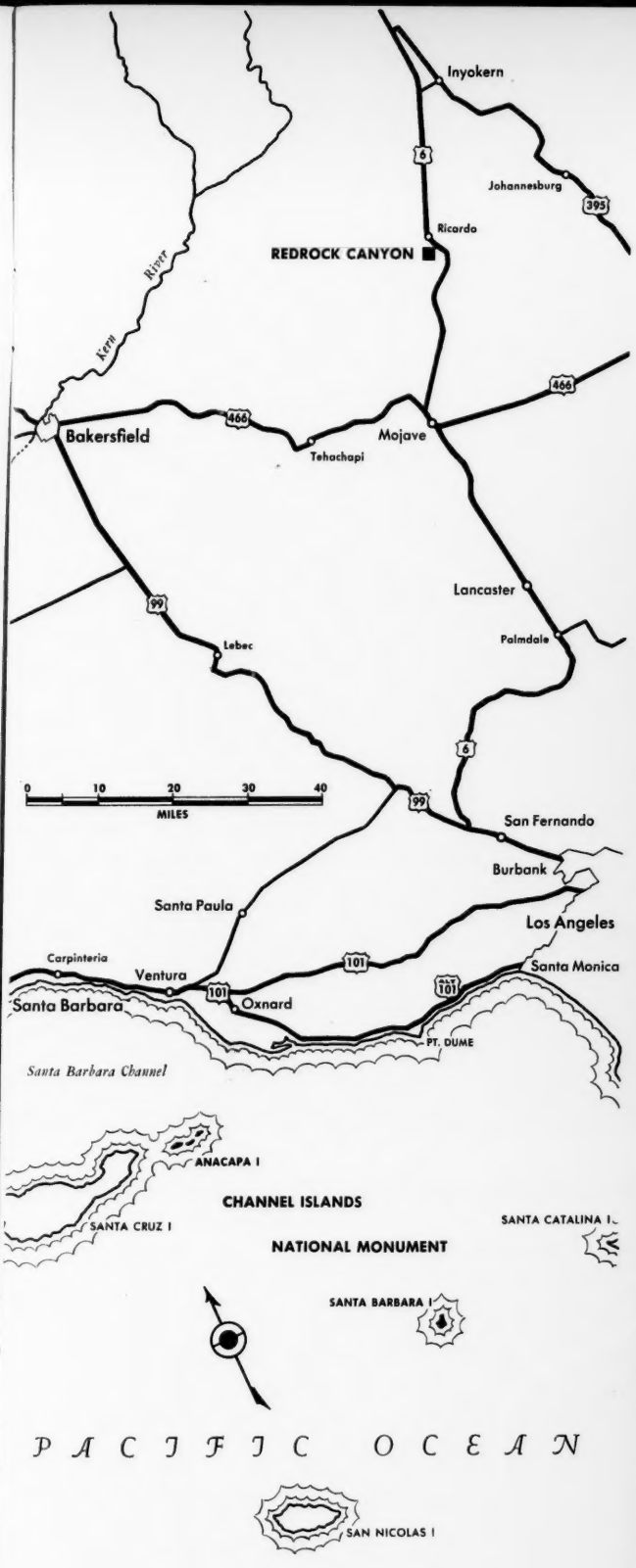
popularly called Cabrillo Arch, after the famed navigator Juan Rodríguez Cabrillo who wintered at the Channel Islands in 1542–43. He died from an accident on neighboring San Miguel Island and is supposed to be buried there. However, it was a century and a half later that British Captain George Vancouver gave Anacapa its present name. It is a Chumash Indian word of doubtful meaning, which Vancouver recorded as *Enneeapah* and *Enecopah*. The cliffs roundabout the arch are streaked white with bird droppings, for here is the nesting colony of 2,000 pairs of California brown pelicans, considered to be the island's chief wildlife exhibit.

The buildings of Anacapa Light Station are grouped on the mesa, west of the arch, with lighthouse and fog signal occupying the highest point. There is no real harbor here, but a landing place and wharf have been built in a little cliff-girt cove. Visitors gain the mesa above by a long flight of iron steps and supplies are hauled up with a large stationary crane. Back in 1868 a lighthouse was recommended for Anacapa, but practical difficulties held up establishment of the station until 1912. Rebuilt in 1932, it is today a modern facility, having up-to-date equipment, attractive Spanish-style buildings, and comfortable quarters. The light is 600,000 candle power and there is a radio beacon and distance finder. Under jurisdiction of the Coast Guard in Treasury Department, Anacapa Light Station is manned by enlisted personnel generally rotated from duty in this lonely, bleak post after approximately one year. There are no springs, streams, or available fresh water anywhere on the island, but this lack has been overcome by covering a couple of acres of slope at the top of the mesa with a smooth surface of cement, which sends rain and condensed fog into an underground cistern.

There are several other anchorages along the shores of Anacapa and a small boat can land anywhere. The best place from which to explore the largest island is a small protected cove on the north side of the west end. The coast here is a maze of caves eaten into the rock and one could probably cross the island through underground passages. Although the steep slopes are apparently treeless, at the heads of ravines are small groves of toyon, island oak, and cherry, species not found on the mainland. It is one of nature's marvels of adaptation that such trees could survive for thousands of years on this tiny isolated island. The beaches and rocks at the base of the sheer cliffs guarding Anacapa's south shore are rookeries for seals, sea lions, and great sea elephants. Often all three of these aquatic mammals can be seen mingling in lazy contentment or disporting themselves in the surf. The cliffs above are nesting places for thousands of murrelets, pelicans, gulls, auklets, cormorants, and guillemots, while the pools and shallow water along the shore abound in marine life. Here are sea anemones, limpets, abalones, crabs, crayfish, lobsters, and scores of other animals and plants. Off the island, too, is some of California's best deep sea fishing—for tuna, albacore, bonito, sea bass, swordfish, whitefish and a host of others. So Anacapa is lonely, barren, and uninhabited only from a human point of view.

The other section of Channel Islands National Monument, which includes Santa Barbara Island and two adjacent rocks, is 40 miles southeast of Anacapa and 25 miles due west of Santa Catalina. This island is a round-topped rocky mass, 1.5 miles long, a mile wide, and 635 feet high. There are so few breaks in its bold, precipitous shores that only one landing place is possible, at a cove on the east side. The two satellite rocks stand offshore, northwest and southwest; Gull Island, the larger, is a jagged fragment of cliff rising sheer 300 feet above the water. Santa Barbara, like Anacapa, is riddled with caverns, holes, and windows, with a large sea arch at the northeast point. It is an important sea lion rookery and nesting place for thousands of water birds. Although barren and treeless, the island is also, strangely enough, the home of many land-bird species as well as resting place for migrants.

Both Anacapa and Santa Barbara were for many years used as sheep ranches. Overgrazing had the disastrous effects on native vegetation, animal and bird life, and greatly accelerated soil erosion. Furthermore, domestic cats abandoned by sheep herders multiplied and preyed constantly on nesting birds. Rabbits introduced from the mainland also became a pest on Santa Barbara. Since the Park Service assumed jurisdiction, however, every effort has been made to exterminate the destructive intruders and protect native vegetation and wildlife so that nature can restore these unique islands to their original condition. Much progress has been made and the visitor to the Channel Islands National Monument today can begin to visualize how these sea-gift fragments of California looked before the coming of man—red or white.



Badland erosion — weak, crumbly sandstone and conglomerate, overlain by equally weak siltstone, with somewhat more resistant sandstone on top.

STORY BEGINS NEXT PAGE ➔

—ONE OF THE WEST'S LITTLE-KNOWN GEOLOGICAL GEMS

AT THE NORTHWEST corner of the Mojave Desert the traveler on U. S. Highway 6 sees red rocks with organ pipe flutings that show what Steno's laws mean. The red rocks crop out especially boldly in low hills just west of the highway, between the flat desert to the south and east and the Sierra Nevada to the northwest.

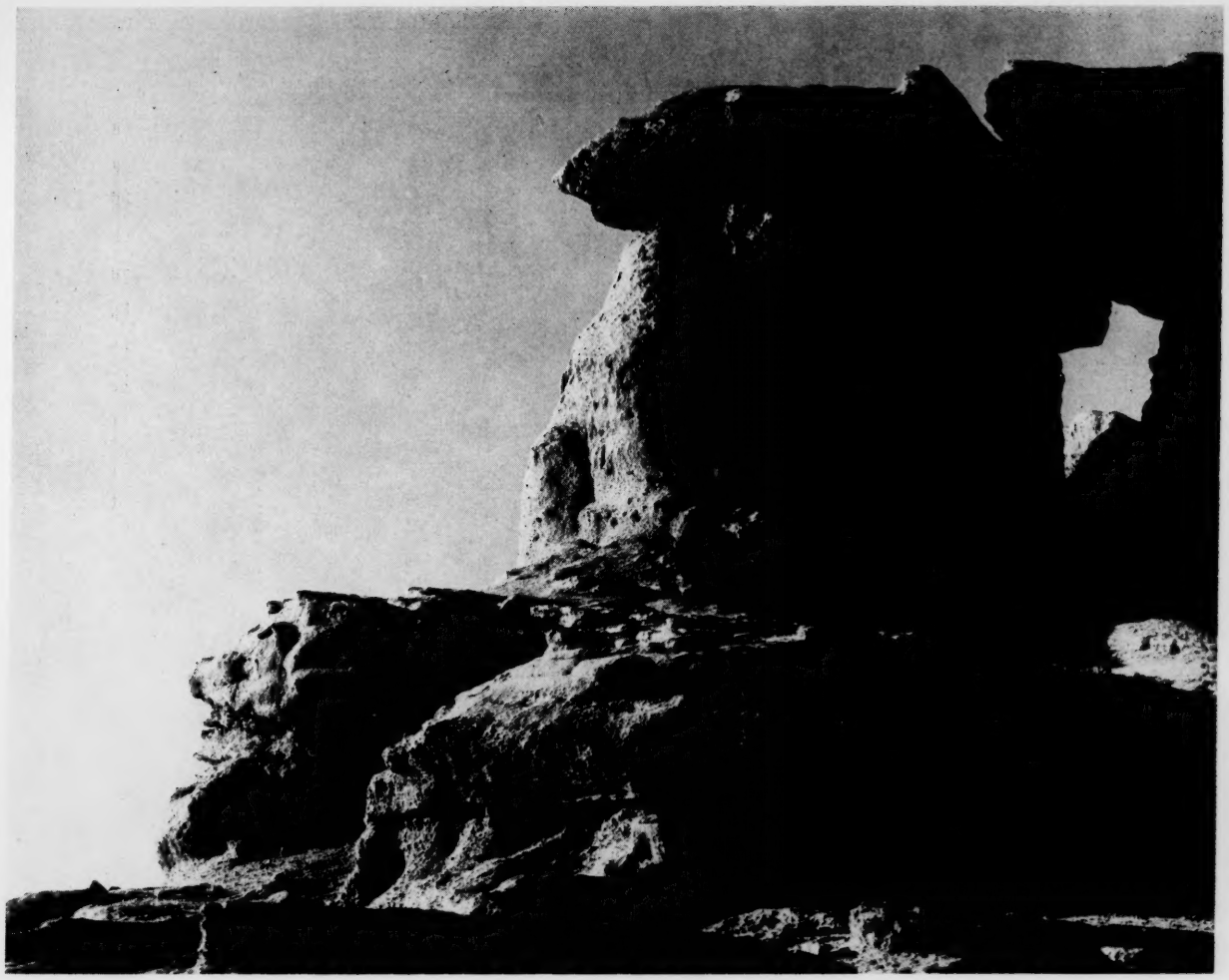
The red rocks are sedimentary strata, some well-cemented and hard, some so soft and loose that they can be picked to pieces with the fingers. The beds dip northwest toward the Sierra, and calculations from their dip and breadth of outcrop indicate that they are about 6,000 feet thick, perpendicular to the bedding. Most are made up of gravel, sand, or mud that has resulted from the disintegration, transportation, deposition, and red pigmentation of originally gray material from granitic rocks like those of the Sierra. Near the base of the thick sequence of beds are several thin black lava flows. One of these shows up as a dark line in an accompanying photograph.

Fossils found in these strata reveal something about the climatic and other conditions that prevailed when the beds were forming. In Last Chance Canyon, just east of Redrock Canyon, beds of volcanic ash that immediately underlie the red rocks contain the petrified trunks of trees that make up a veritable fossil forest.* Some of these trunks were still standing up-

*Compare "Groves of Stone," *PD*, May-June 1951.

↑ *Northwest-dipping redbeds at Redrock Canyon, California, showing also a black lava flow capping the hill.*

→ *View northeast at Redrock Canyon shows the true dip of the sedimentary rocks and the interbedded black lava.*



Detail of the red rocks: the lower one-third is sandy conglomerate, grading upward into silty sandstone and capped by harder calcareous sandstone. Erosion of softer rock made the window.

IS **Story—A. O. WOODFORD : Photos—BLACKMER HUMPHREY**

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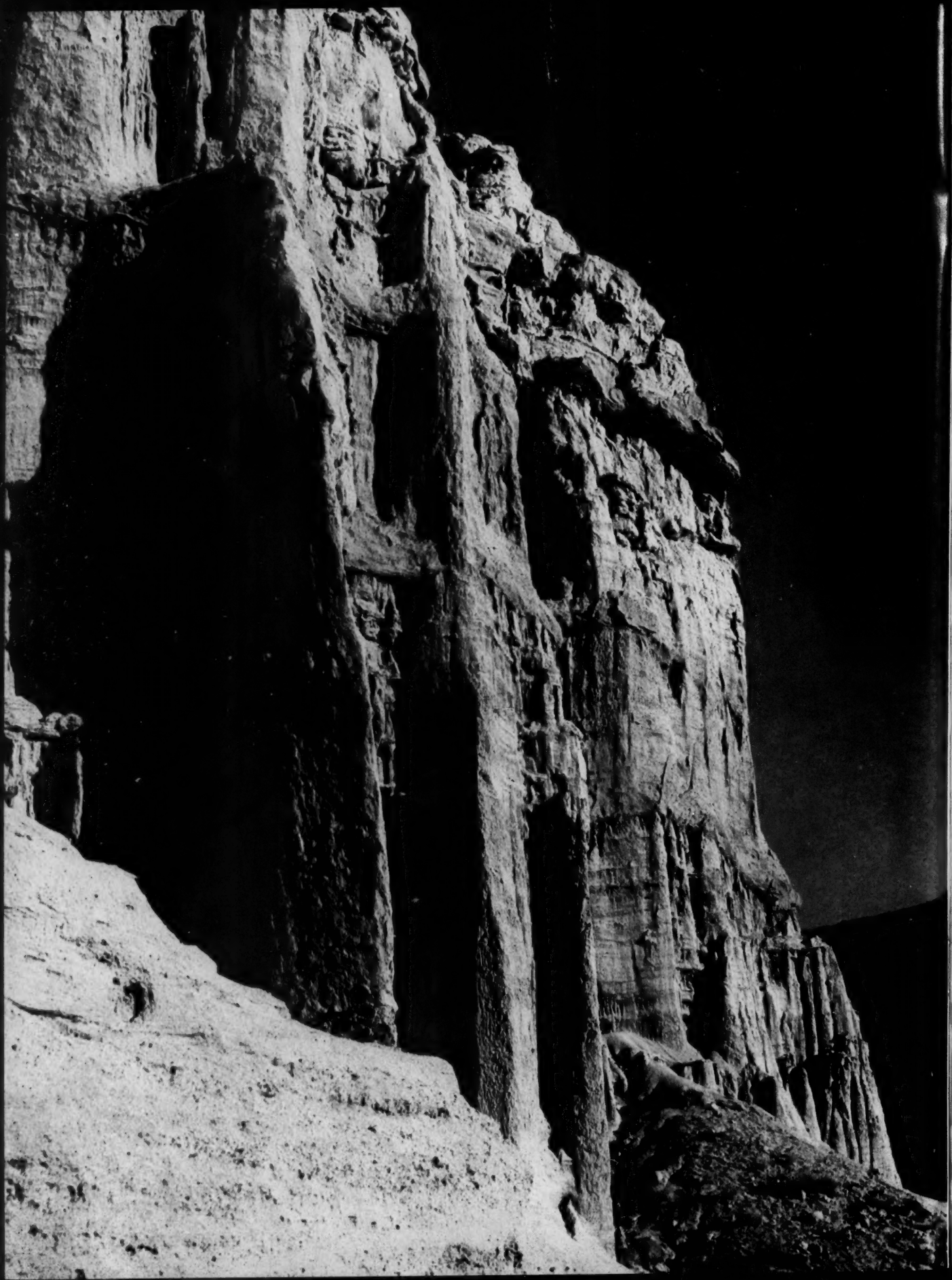

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right, until removed by vandals; the trees must have been buried by sudden thick ash falls.

Higher in the section, above the black lava flows, the bones of land mammals have been found: horses of several kinds, camels, dogs, sabertooth tigers, and mastodons. The dogs, horses, and camels are different from their living relatives and mostly considerably smaller. The sabertooth tiger and mastodon are somewhat like those of the Ice Age, but notably smaller. The Redrock assemblage is a well-known pre-Ice Age fauna, called early Pliocene by geologists. The Redrock and the Ice Age faunas both include the large herbivores and carnivores that are now so strikingly absent from the Mojave region. The native recent desert fauna is characterized by the jackrabbit and the wildcat; it includes no animals larger than antelope or coyote.

Judging by the fossil forest and the big mammals, the series of beds at and near Redrock Canyon was deposited at a time when the climate of the region was considerably wetter than it is today. On the other hand, the geologist has come to think of redbeds as the natural associates of thick salt deposits, and salt deposits indicate an aridity so extreme that lakes dry up and deposit their dissolved salts. Perhaps the two lines of evidence, taken together, indicate a generally semi-arid climate, with local upland basins that contained forests and favored the existence of a moderate number of large animals, a climate—and a geography—not unlike that of much of the present South African veldt region.

But how were the red rocks tilted, and how were they exposed to view? This is where Steno comes in. Nicolaus Steno was a Dane, a physician to the Duke of Florence. In 1669 he published a little book* that is the cornerstone of the science of geology. His simple, commonsense laws enable us to draw notable conclusions just from a look at such exposures as those in Redrock Canyon. These laws have survived the critical study of generations of geologists.

Steno's first law states that in a series of strata the upper beds are the younger. We used this obvious rule to find the relative ages of the fossil forest (below the lavas) and the mammal beds (above the lavas). By the same token, the lavas themselves are of intermediate age. This simple law is the basis of all historical geology.

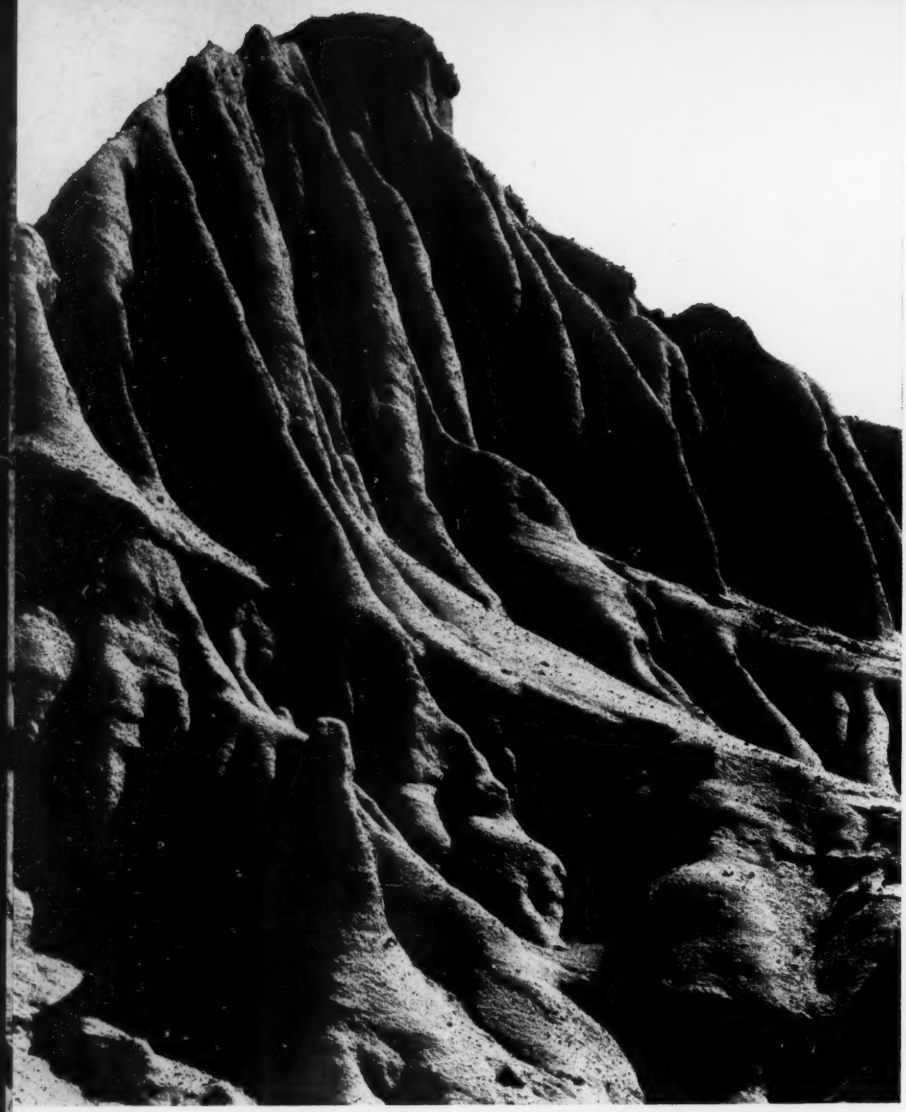
Steno's second law states that sedimentary beds are practically horizontal when first deposited. Therefore dipping beds, like those in Redrock Canyon, have been tilted since their formation. These beds dip down toward the Sierra, and the Sierra is composed of solid granite instead of beds made up of granite fragments. The sudden change in the nature of the rocks comes at the great earthquake fault that follows the base of the Sierra. Apparently the red rocks were faulted down against the Sierra block. On the opposite, or southeast, side the red rocks are faulted up along another large fault. Apparently the whole block that includes the red rocks has been rotated, down on its northwest side, up on its southeast side.

Steno's third law states that newly deposited strata continue until they feather out or reach an abutment.

De solido intra solidum naturaliter contento is the title.

Badlands erosion in conglomerate sandstone, dipping to the right. Color bands across the flutes were made by bedding.

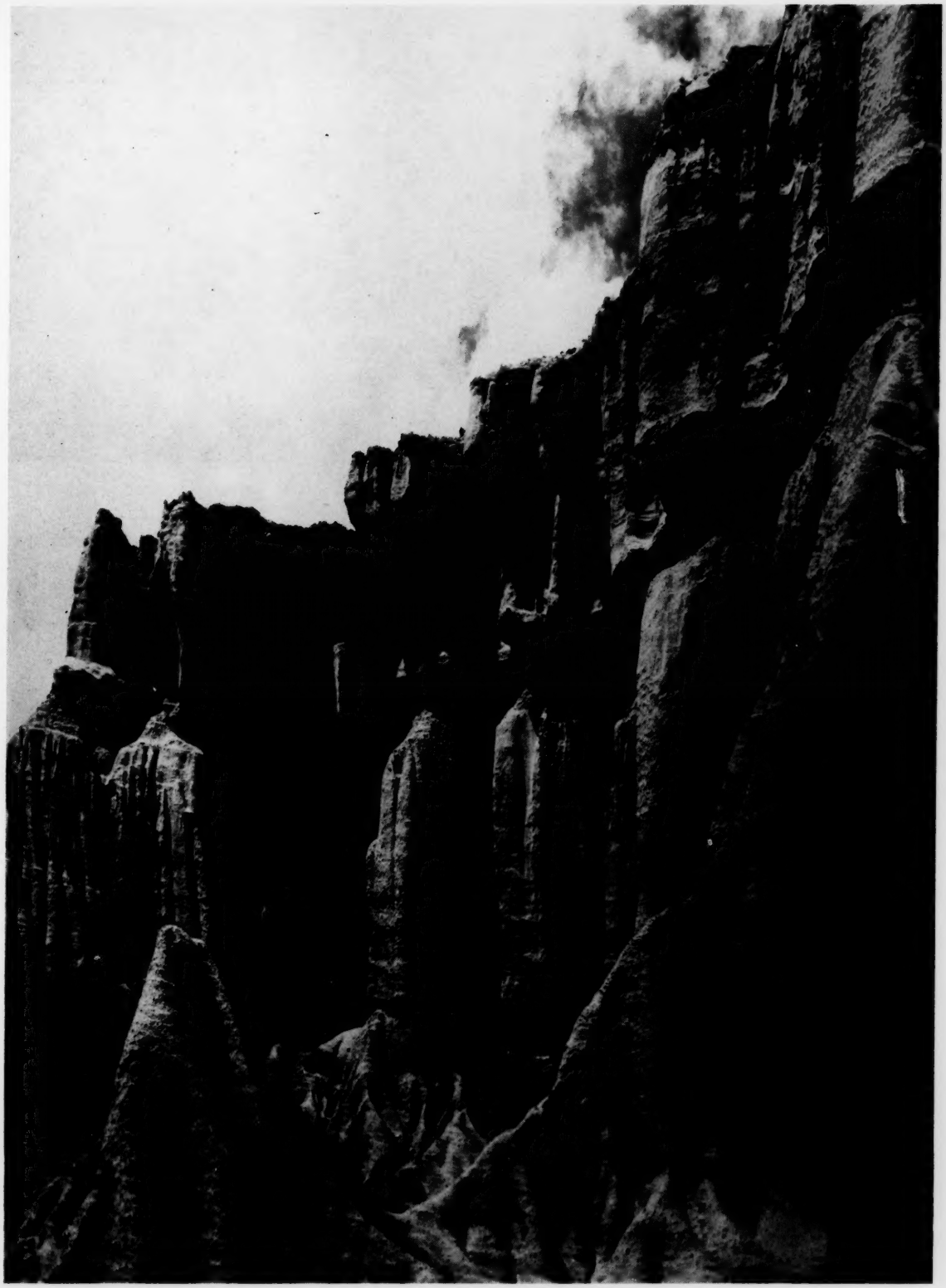
Well-bedded sandstone with thin layers of pebbles. The organ-pipe weathering is the striking characteristic of Redrock Canyon and similar formations.



Only the top of the youngest bed may then be exposed to view. If the edges of, and sections through, a pile of strata are exposed, the continuations of the exposed beds must have been removed by faulting or by erosion. Here erosion has been at work, in addition to faulting. Erosion is shown by the rill courses between the fluted ridges shown in the photographs. Erosion on a somewhat larger scale is shown by each little gully. Erosion on a still larger scale is shown by the existence of the valley —Redrock Canyon—by which the highway leaves the low desert and climbs northward toward Owens Valley. Among other things, erosion brings out the differences between beds shown in several photographs, even extending to the formation of a natural bridge (a hard stratum) with an opening beneath (in a weak stratum). Many a touch by the sensitive tools of erosion has brought complexity to the land forms in Redrock Canyon.

Typical badlands erosion features in pebbly sandstone that dips about 20 degrees to the right.

Detail of the red rocks: conglomerate bed a few feet thick between layers of finer-grained pebbly sandstone. The sandstone layer at the top is better cemented and so more resistant to erosion.



Bedding in the red rocks is strongly accentuated by differences in resistance. The lower, weaker beds weather in the organ-pipe form. Scale is well-indicated by the desert chaparral shown on page 16.

WHALES AGROUND IN CORTÉS' SEA*

TRAGIC STRANDINGS IN THE GULF OF CALIFORNIA

RAYMOND M. GILMORE

IN THE GULF OF CALIFORNIA, which is a long Mediterranean-like sea to our south, are many whales; and here recently occurred some tragic strandings of these huge marine mammals – tragedies which, by the number of their victims and by the accurate and complete documentation by highly intelligent and educated spectators, can be used with confidence to increase our scientific knowledge of the distribution and habits of whales.

The first of these strandings to come to my attention was that involving 22 bull sperm whales on 16 January 1954 at La Paz on the end of the peninsula of Baja California, near the mouth of the Gulf. This highly dramatic incident took place at the very doorstep of a large and fairly modern town, and was preceded at exactly the same place by the grounding and death of a single baleen whale – probably a humpback – three months earlier in October 1953; and also by the death on the beach of a small group of small pilot whales in November – three separate strandings.

Later in 1954, I learned of an even earlier tragedy which took place on 12 April 1953 at Cabo Tapoca, near the head of the Gulf. Here, in the pitiless sun of the Sonoran desert nine bull sperm whales died a lingering death. Finally, on 28 December 1954, occurred the last of this described series of strandings, when a lone bull sperm whale came ashore and died at San Felipe, closer to the head of the Gulf and Cabo Tapoca, and on the west or Baja Californian side.

The cases will be dealt with in chronological order.

*Published by permission of the director of the U. S. Fish and Wildlife Service.

On 12 April 1953 a Mr. Glenton G. Sykes, City Engineer of Tucson, Arizona, arrived at Puerto Lobos, which is a remote fishing village just south of Cabo Tapoca, Sonora. He had reached this place, which is 175 miles south of the mouth of the Colorado River and 200 statute miles north of Guaymas, by driving some 200 tortuous miles at low speeds over the desert from Nogales, Arizona.

Mr. Sykes did not go fishing with his companions the first morning, but explored the long sandy beaches to the north. As he climbed the high land of Cabo Tapoca, he saw his first stranded whale, a great, dark blob on the beach in the distance. Progressing further, he soon found nine dead whales. There the carcasses lay, exposed to the blazing heat at the edge of the ocean and desert. Fortunately they were but recently dead, perhaps from only the night before. Also, all were sperm whales, as the photos and descriptions clearly proved. Sykes also stated that:

> The true cause of the disaster may possibly never be determined; all I know is that it was during the dark of the moon, and the tides were very high (in this part of the Golfo they probably are about 14 feet maximum), and possibly the big mammals ran aground in a burst of extra enthusiasm. I chanced to have a six-foot rule along and made some measurements. The longest whale measured about 45 feet in length and the smallest about 35. They were a shiny, jet black, very smooth, with tails measuring 14 feet across; they had rows of short conical teeth in the lower jaw, 13 to 15 on each side, and a rough computation indicated that they probably weighed somewhere between forty and fifty tons apiece.

Bull sperm whales beached at Cabo Tapoca, Sonora, April 1953 — nine victims of a mass tragedy. The upper end of the Gulf of California has a tremendous tidal range which leaves a vast expanse of sand at ebb tide. (Photograph by Glenton G. Sykes, Tucson, Arizona)

All in all it was quite a display. On the third day their presence was distinctly discernible without the aid of an ocular examination, and standing close to them one got the impression of a boiler getting ready to blow up. All of the buzzards in northern Sonora had evidently been alerted and, [on my way out a few days later], I met coyotes coming in, thirty miles back.

That the stranding took place during the dark of the moon is significant. It so happens that in certain sperm-grounds near shore, the commercial catch jumps at this lunar phase, as if the whales were more active. Sperm whales then work closer to land, perhaps as a result of similar movement of their food, the squid. We know little of this lunar periodicity in whales and squid, but with more observations, a pattern of extremely interesting behavior may become evident.

The day after the discovery, Sykes climbed the low hills back of the beach, possibly 200 to 300 feet in elevation. He remarked in the same letter:

I was able from this vantage point to note that there were a great number of whales two or three miles off shore. I could see most clearly the spouting, plumes of water or whatever it is they do spout, sometimes a dozen or more in view at the same time; and, as I watched, I noted that at no time were there less than three spouts going on simultaneously.

These might have been other sperm whales, or they may have been finbacks which inhabit the upper Gulf in numbers all year in what appears to be a "landlocked" population. These latter spout a high plume of vapor from their condensed breath – no sea water is exhaled from the lungs by any whale. That sperm whales are found so far up this inland sea is, however, a revelation, though previously we have known of their presence in the deep water of the Ballenas Channel between Isla Angel de la Guarda and Bahia Los Angeles to the west and south of Puerto Lobos. There is no deep trough in the floor of the Gulf at Cabo Tapoca as there is farther south, but the waters just off the shore go down to 20 and 30 fathoms and evidently this is sufficient for the sperm whales, though I think they prefer deeper water as do the large squid, their food.

Glenton Sykes examined all the nine whales at Puerto Lobos and concluded that seven were males and two were females. However, there is a chance of error here, and this is worth noting by those learning about whales. Male sperm whales, as well as the males of other species of whales and porpoises, can have the appearance of females when the organ is concealed in the long genital fold, as it is during normal activities, thus leaving unbroken the smooth contour of the body and the laminar flow of water. Many males have thus been erroneously identified as females even by experienced whalers who did not look close enough at the inguinal region to note the perineal length between vent and genital opening, which is long in the male and very short in the female.

Another fact which convinces me that all were males is the length, which in the adult female averages 34 or 35 feet, and only rarely as much as 40; whereas, males reach 60 feet and average perhaps 45 to 50 when full grown. Thus, it is practically the rule that any sperm whale over 40 feet is a male, and most over 38 feet likewise. Moreover, where females are found, the herd is a harem herd, and they outnumber the males 5 or 6 to 1. Standard length is measured in a straight line from tip of the upper jaw or head to the notch or center of the flukes.

Sykes gave the number of teeth in each side of the

Each claimant cuts blubber from his whale to render oil after the beaching of twenty-two bull sperm whales at La Paz, 16 January 1954. About 60 barrels of sperm oil and spermaceti were collected. (Photograph by Miguel Rodriguez, La Paz, Baja California)

lower jaw as 13 to 15, which may have been an undercount due to concealment of some within the mouth. Ordinarily, sperm whales have from 18 to 25 on each side of the narrow lower jaw.

Now we pass about 500 miles or more to La Paz, a beautiful city in the Cape region of Baja California facing the Gulf. It is the capital of the southern territory of the Peninsula, and is situated on an inner and almost landlocked bay, the Ensenada de Anpe, which opens northward through a narrow channel into a huge open bay, or bight of the Gulf, the Bahia de La Paz.

It was in the inner bay, or ensenada, one day in October 1953 that

> . . . a rather large whale, forty feet or more, entered and grounded itself about a quarter of a mile off the bathing beach, Corumel.

Mrs. Margaret Waters, American resident of La Paz, and one of the amateur scientific observers mentioned above, who contributed so much to the documentation of the strandings, described the event in a letter to me of 15 December 1953, continuing as follows:

> Although it seemed that the whale could have swum free at high tide, it lay there awash for two days spouting at frequent intervals. Enterprising fishermen charged a fare to run boatloads of people out to take a look. It finally expired and after a certain period, well filled with gas, floated across and came up in front of the president's house. There it disappeared before it got smelly, probably having been removed by the authorities.

There were no detailed descriptions or photographs of this whale, so I guessed it was a humpback because of the prevalence of this species in the lower Golfo. The humpback has been seen in numbers in winter around the Cape region of Baja California, as well as eastward near the Tres Marias Islands and the tiny island of Santa Isabel just off the port of San Blas, where they apparently calve and mate.

This stranded baleen whale was partially awash well out from shore in shallow water at both high and low tide, and thus could not be reached by people on foot nor was it visible completely to those in boats. Hence the long and diagnostic flippers of the humpback and the equally prominent and characteristic knobs on the head were apparently not noted. The carcass later beached for so short a time that whatever characters it may have had of prominence were not solidly impressed in the memory as objects of later conversation.

The whale remained alive for two days in shallow water though completely grounded, which is a most interesting fact, because it appears to contradict the theory that death is caused by the great weight of the body crushing the chest. This chest-crushing theory probably also maintains that the lungs of a whale collapse on a deep dive — another dubious theory, but one which space does not allow me to discuss here.

The tide at La Paz is small, three feet or so, but it was sufficient when low to almost completely expose the animal. Nevertheless, in this case, and in spite of the great weight on the chest, the animal was slow to die.

Actually, the "upright" or normal position was favorable for survival of the whale because it allowed breathing to continue out of the nostrils at the top of the head without the entry of water — an event which would have quickly caused asphyxiation and death through lack of air. And, at high tide, this whale was partially awash and thus cooled from excessive blistering in the hot sun.

For the death of a beached whale is, I believe, due in most cases to drowning because of a side position of the body, which is the usual position of a whale on a hard surface such as the beach, and which permits water to enter the blowholes before the body can refloat on the rising tide. Death can also be caused by overheating in the sun, and can take place quickly. The skin of a whale has no sweat glands. The shock of beaching might also be fatal to an otherwise uninjured whale. And, of course, injury from collision with ships at sea or from battering in storms can cause death either before or soon after the whale hits the beach, and not be recognized as such.

The second influx of whales to La Paz was also described by the able Mrs. Waters:

> A month afterward, La Paz received a sad immigration of dark-gray colored animals, locally called "bufeos." Two swam into the shallows in front of the Hotel Misión [well within the bay by a mile or so], and threshed about in their death flurries. They were boarded by small boys who delighted in bouncing up and down on their bodies. Another beached in front of the Los Arcos Hotel [a mile further up], and several more came ashore farther down the bay. [They were] about twenty feet or less, small-mouthed, with square worn teeth. . . .

These whales, as shown by her photo, clearly were pilot whales, *Globicephala,* which is a common species throughout the entire Golfo most or all of the year. It also has such a tight social organization that disaster to one almost invariably means disaster to all because they stick together. This trait allows the Faeroe Islanders and Newfoundlanders to drive hundreds ashore at one time by turning the leader or front of the pod toward the beach and creating such a din and commotion that they plunge wildly to their death. Pursuing killer whales, or some merely nearby, can cause whole schools to pile up on the beach.

At La Paz, finally, on 16 January 1954 the climax of tragedies occurred when 22 sperm whales plunged into the inner bay and drove themselves on the south

shore at various intervals for a distance of several miles. There, in a welter of spray and sand, they soon expired to the wonder and excitement of crowds of people who gathered to watch the drama. Such was the intensity and magnitude of interest shown, that newspapers of our West Coast carried accounts of the happening; and, so strange was the truth, that, when a false rumor was circulated in late February of another group meeting the same fate, wide credence was given, and a local pilot set up quickly to do business for the curious from Alta California without checking beforehand.

Concerning this spectacular mass-stranding of sperm whales, Mrs. Waters wrote to me under date of 19 January 1954:

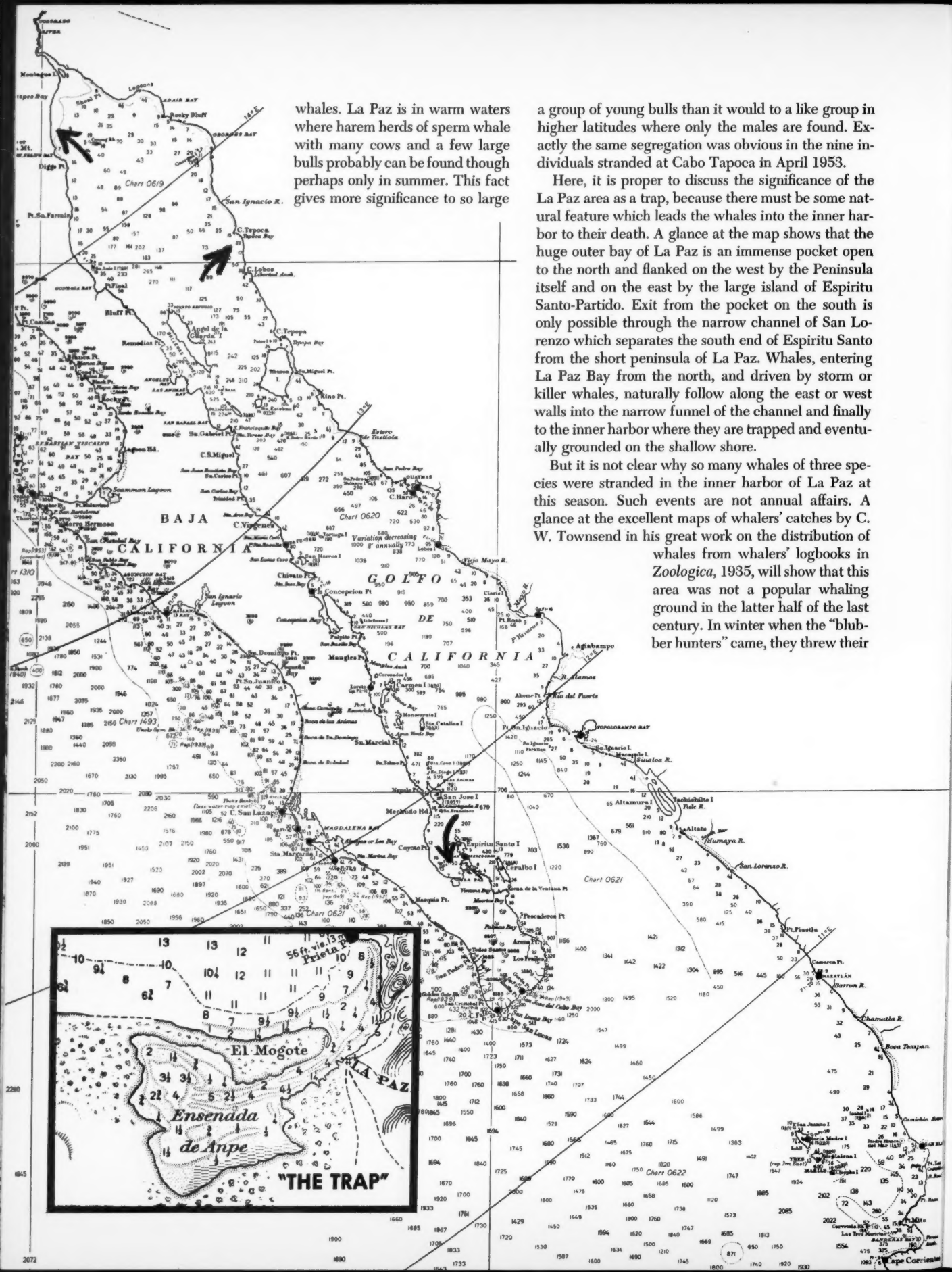
. . . 22 sperm whales beached themselves in front of the bathing place at Corumel, all along the waterfront [or La Paz] clear up to the boat yard [about 3 miles from Corumel]. There they lay, head on the shore, great black-gray humps, heaving in their death flurries till they died, and were scaled by small boys who slid down their sides. The local people finally pronounced them to be "cachalote" too. . . . I stepped off one of forty feet in length and they seemed to be generally of uniform size. I was reminded of a crazed bunch of marine sheep who apparently followed their leader to their death.

There was no doubt of Mrs. Waters' identification that they were sperm whales. Many photographs were taken of nearly all the whales shortly after death, and three carcasses still remained near town for the inspection of Dr. Gifford C. Ewing and I when we visited La Paz on 6 February during an air flight in connection with the annual gray-whale census of the U. S. Fish and Wildlife Service and the Scripps Institution of Oceanography, La Jolla, California.

It was also well established that *all* these stranded sperm whales were males, and in size between the narrow range of 35 to 40 feet. In this matter, the observation of Ewing and myself checked with those of Mrs. Waters and Sr. Luis Collins, manager of the Hotel Mision. Sr. Collins examined nearly all the individuals carefully at the time he took photos of each.

This leaves us with the conclusion that *male* sperm whales sometimes go in large segregated pods of similar age and size, at least during their immature years; and, that organization of such pods is tight enough to draw all to their death together, as with the pilot

This 43-foot bull sperm whale went ashore a few miles north of San Felipe Bay, Baja California. Mr. and Mrs. Charles E. Berger and their son of Imperial Beach found it about 28 December 1954. (Photograph by Earl E. Berger, Imperial Beach, California)



whales. La Paz is in warm waters where harem herds of sperm whale with many cows and a few large bulls probably can be found though perhaps only in summer. This fact gives more significance to so large a group of young bulls than it would to a like group in higher latitudes where only the males are found. Exactly the same segregation was obvious in the nine individuals stranded at Cabo Tapoca in April 1953.

Here, it is proper to discuss the significance of the La Paz area as a trap, because there must be some natural feature which leads the whales into the inner harbor to their death. A glance at the map shows that the huge outer bay of La Paz is an immense pocket open to the north and flanked on the west by the Peninsula itself and on the east by the large island of Espiritu Santo-Partido. Exit from the pocket on the south is only possible through the narrow channel of San Lorenzo which separates the south end of Espiritu Santo from the short peninsula of La Paz. Whales, entering La Paz Bay from the north, and driven by storm or killer whales, naturally follow along the east or west walls into the narrow funnel of the channel and finally to the inner harbor where they are trapped and eventually grounded on the shallow shore.

But it is not clear why so many whales of three species were stranded in the inner harbor of La Paz at this season. Such events are not annual affairs. A glance at the excellent maps of whalers' catches by C. W. Townsend in his great work on the distribution of whales from whalers' logbooks in *Zoologica*, 1935, will show that this area was not a popular whaling ground in the latter half of the last century. In winter when the "blubber hunters" came, they threw their

harpoons into the gray whales on the west coast of Baja California, and into sperm and humpback whales near the tip of the Peninsula, but they did not enter the Gulf in any numbers.

Now, to bring this story up to date, another sperm whale grounded itself on the beach near San Felipe Bay, on the west side, across from Puerto Lobos, and even farther up the head of the Gulf, which proves that sperm whales, so far up, and in water so shallow, is no freak of distribution, though they may be trapped by efforts to migrate north into a dead-end.

On or shortly before 28 December 1954, a bull was discovered and photographed by the family of Charles E. Berger of Imperial Beach, San Diego, California, and by Dave Fink of Newport Beach. The animal was 43 feet long and 8 feet across the back, as noted by Mrs. Charles Berger who also saw a school of whales blowing offshore — perhaps companions of the ill-fated one dead on the shore.

The strandings at San Felipe and Cabo Tapoca can be immediately blamed on the quick and far run of the tide, which is an imposing phenomenon in this area and which can catch an unwary whale high and dry in short order. Another feature to notice is that all the sperm whales in the entire story are males; and it is quite likely that the upper Gulf is inhabited exclusively by this sex, which migrates and lives in the colder waters in other parts of the world to the exclusion of the females that remain in the warmer waters in harem herds. The Gulf of California parallels the Pacific Coast across the Peninsula in water temperature: colder in the north, warmer in the south.

Thus we end a story of tragedies of whales, particularly sperm whales, which have stranded singly or en masse, in the Gulf of California within the short period of almost two years. Three of these occurred in one locality within 90 days. Several of these emotional dramas were observed by laymen who reported so ably that we can utilize their observations in our body of scientific knowledge. The value of their contributions, moreover, can be increased by additional knowledge of whales on their part, and it is our hope that those who are fortunate enough to witness similar incidents in the future will report as ably. Cetologists, or the students of whales, are too few to cover the broad expanse of our coastline, and must therefore rely on the knowledge and enthusiasm of these and other outdoor people.

We have learned much of the distribution of the sperm whale from these strandings, as well as much of the segregation of young males and the tight organization of their group which can keep all together, even in the face of death, in what seems a cruel waste of life. This is one of the unexplained mysteries of nature, and the best we can do now is to look, listen, measure, and write down all the data.

The chart of Baja California and the Gulf is reduced from part of U. S. Navy Hydrographic Office Chart No. 1006. The inset of the Ensenada de Anpe is from N.H.O. No. 1664. Arrows point to the whale strandings.

The King Snake

WELDON D. WOODSON

SLOWLY, but inescapably, the two-foot snake disappeared head foremost into the body of another snake, a little larger. Snakes often devour animals even larger than themselves, and frequently eat other snakes. The interesting fact was that the snake doing the vanishing act, involuntarily, was a Pacific rattler *(Crotalus viridis oreganus)*. Surely, one would think, his poison apparatus would assure him against such a rôle. Yet there he was thrashing about and sounding his rattles, while all the time his exposed portion became less and less.

As for the impresario, he was none other than the California king snake (*Lampropeltis getulus californiae*). Were it not for the victim being engulfed, his glossy black scales interspersed with rings of white would impress you as beautiful. Upon second thought, you should not hold this against him, for all life — including that we call human — feeds upon other forms of life, either animal or vegetable. Moreover, the creature he was subduing was a dangerous rattlesnake.

The king snake is our friend indeed. King snakes are found from southeastern Canada to southern Ecuador. Wherever they have for neighbors the rattlesnake, they are reputed to destroy them. They are also known to eat the water moccasin and copperhead. They are immune to the venom of each of these reptiles.

In a whimsical mood, the late Raymond L. Ditmars once pictured the possibility of a king snake in the process of swallowing a snake, head first, when a larger king snake begins at the tail. Finally they reach each other, snout to snout, with their rope-like prey partly in the body of one, partly in the other. With only a moment's hesitation the bigger one continues and swallows its own kind. Ditmars stated, however, that barring such improbable disputes, king snakes themselves will live amicably together for years.

During the latter part of the past century, Dr. H. C. Yarrow described a specimen in a museum that had two perfect heads, one a little larger than the other. The two gullets united to pass into the

one stomach. One is tempted to imagine what would happen should both heads seize a rattlesnake at the same time.

The eating habits of king snakes have attracted the attention of scientists, explorers and the general public for many years. In 1842 John Edwards Holbrook, an early American herpetologist, told of the common belief that it is a great enemy of the rattlesnake, although he himself did not find much evidence to support this.

In 1878, Dr. Elliott Coues also remarked the layman's contention that it wages constant warfare against poisonous snakes, and that it is uniformly victorious and eats its victims, such prowess giving it the name of "king snake."

In 1900, Professor Edward Drinker Cope mentioned its reputed penchant for rattlesnakes, at the same time declaring that he personally had never seen it eating these serpents.

Now it is generally accepted that the king snakes feed upon rattlers, but science conflicts with commonly accepted opinion — they don't single them out as their prey. To be sure, a hungry king snake meeting a rattler will make a meal of him. But so would he dine upon a non-venomous snake, a rat, mouse, pocket gopher, bird or lizard. Since the latter two, as well as many harmless snakes, often destroy pests injurious to crops and man, some have wondered whether the king snake is as much

Glossy black and ringed with white, the California king snake is a beautiful reptile. (Photos by Keith Boyd)

our ally as proclaimed. Even so, one must not minimize his good work in reducing rodent hordes as well as killing poisonous snakes.

The king snake overpowers mammals by constriction. Wrapping his coils about his prey, he crushes it — tighter and tighter — until death comes. As for snakes, he would make little headway by this method He goes about it like other snake-eaters. He seizes his victim at any point he can reach, then works his jaws toward the head. He swallows that part first, using his coils only to lessen the victim's struggles.

The California king snake comes in two different patterns, at least those found in the vicinity of San Diego do. There is the familiar black-and-white-ringed one; the other runs a narrow white stripe lengthwise down the center of the back from head to tail, usually with a wider and less clearly defined white stripe on the sides. The belly may be plain white, or have a large black area taking up most of the center.

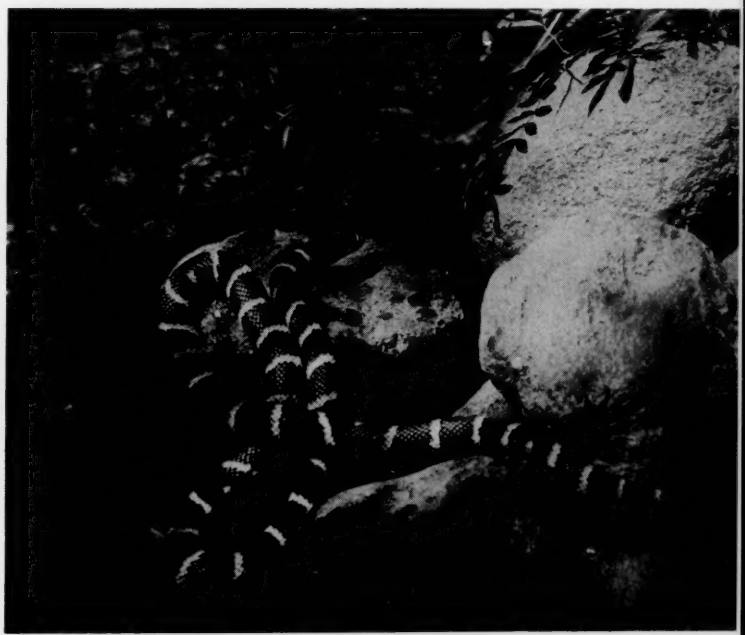
Here must be two species, you may conclude, and in fact so it was thought for nearly a hundred years. Then in 1936, C. B. Perkins of the San Diego Zoological Society succeeded in hatching eggs from mothers of both types. He found both patterns in the young from each parent, proving they are of the same subspecies: *Lampropeltis getulus californiae.*

Found throughout much of the state which gave it its common name, the California king snake has also been reported from southern Oregon, northern Baja California, southern Nevada, southwestern Utah, and most of Arizona. The dominant color usually is jet black, but it may be brown, and the crossbands mostly are milk-white, although these sometimes are of a yellow hue. As listed by Ditmars, other king snakes in California are the California coral king snake, *L. zonatus,* Arizona king snake, *L. getulus yumensis,* and the Santa Catalina Island king snake, *L. catalinensis.*

Rarely can one see for long a king snake foraging for food in the wild. Recorded observations often pertain to their stalking another reptile, as a snake or a lizard. An exception comes from John Van Denburgh, who saw a California king snake crawling along the ground, looking up into the bushes for nests of small birds. "Several times while I watched," he relates, "its quick eyes detected nests three or four feet above it, but although the snake immediately climbed up to these, it did not obtain a meal, for the nests which it examined had been abandoned by their builders or robbed by some earlier comer."

Our look at the king snake must not end without revealing that, although antagonistic toward the rattler, he is exceptionally docile as far as man is concerned. Quite true, upon your first capturing him he may try to bite and chew you, and, serpent-like, squirm in an effort to free himself. Powerful constrictor that he is, he may startle you by unceremoniously squeezing tightly your hand or arm. Within a few minutes, however, he will yield himself to your care. As pets, they are hardy and good-natured.

For their food, give them what they are accustomed to in the wild, but not, if you are a novice, the rattlesnake. Only a trained herpetologist should handle poisonous snakes. It is better for the beginner to offer it a glass of milk, literally. Professor Cope tells that his daughter when a girl of six or eight had several king snakes as pets. "They drank milk readily from a cup which she held in her hand," he writes.



All of which, if this were an essay on teetotalism, could be made to prove something. Since we are merely introducing the king snake, however, let's just give him his due for taking a few rattlers out of our path.

Last frontier

MAN NEEDS FRONTIERS. *In Antarctica this mid-century he is rapidly using up his last one on Earth's land surface. At the same time, spear-headed by science fictioneers and sundry engineers, he is – or at least thinks he is – about to open the frontier of space beyond the planet. Meanwhile, quietly over at least a century but with augmented fanfare in the last decade, some men have recognized and set out to explore the veritable last frontier of Earth – the sea. Since the* Challenger, *oceanography has grown into a major science. Since Cousteau, skin diving has become a capital sport, its equipping a new industry. Books about the sea and its exploration are crowding publishers' lists. These are selected from the crop of two years since our "Beneath the Blue Ceiling"* (PD, *VII-6*):

The Underwater Guide to Marine Life. By Carleton Ray and Elgin Ciampi. Illustrated by Teiji Takai. A. S. Barnes and Co., New York. 1956. xiii + 338 pp., full-color plates, halftones, line figs. $8.75.

Growing interest in the sea and its life is stimulating the publication of many fine books on the subject, one of the newest and best of which is contributed by two graduate students of biology at Columbia University – Carleton Ray and Elgin Ciampi. Both ardent skin-divers and spearfishermen, these young men have prepared a guide to the life of the ocean floor in North American waters. With this book, a diver can identify, at least to "group" or genus and often to species, the common plants, invertebrates, fishes, reptiles, and mammals that occur on both the Atlantic and Pacific coasts of the continent. The volume is well illustrated with underwater photographs (many in color) and with drawings and paintings by the talented artist, Teiji Takai. Moreover, there is included in the beginning chapters of the book a highly illuminating discussion of the elements of oceanography and ocean ecology. The treatment is much broader than one usually finds in a conventional guide book.

The introduction to the volume, concerning the problems of conservation of underwater resources, was made available to the editors of *Pacific Discovery* well before the book was published and caused us to ask the authors for the article "Taking Conservation Underwater" that appears in this issue of *PD*. The article and accompanying illustrations are only a foretaste of what the reader will find in the book. A.S.L.

The Gates of the Sea. By Philippe Diolé. Translated from the French by Alan Ross. Julian Messner, Inc., New York. 1955. 176 pp., 17 photos, map. $4.50.

Man and the Underwater World. By Pierre de Latil and Jean Rivoire. Translated from the French by Edward Fitzgerald. G. P. Putnam's Sons, New York. 1956. 400 pp., 18 halftones, 55 text figs. $5.00.

Man Under the Sea. By James Dugan. Harper & Brothers, New York. 1956. xi + 332 pp., 82 halftones, text figs. $5.

2000 Fathoms Down. By Georges S. Houot and Pierre Henri Willm. With an Introduction by Jacques-Yves Cousteau. Preface by Philippe Tailliez. Translated from the French by Michael Bullock. E. P. Dutton & Company, Inc., New York. 1955. 192 pp., 16 photos, 8 text figs. $4.00.

Vastness of the Sea: *Adventure in the Mysterious Depths.* By Bernard Gorsky. Translated from the French by Alec Brown. Little, Brown & Company, Boston. 1957. 305 pp., 18 photos, 2 maps. $5.00.

The Underwater Naturalist. By Pierre de Latil. Translated From the French by Edward Fitzgerald. Houghton Mifflin Company. Boston. 1955. 275 pp., 11 photos, 24 text figs. $3.50.

Skin Diving and Exploring Underwater. By John Sweeney. McGraw-Hill Book Company, Inc., New York. 1955. x + 176 pp., 8 photos. $3.50.

The Art of the Aqualung. By Robert Gruss. Translated from *Manuel de l'homme sans poids* by Richard Garnett. Philosophical Library, New York. 1956. 66 pp., 8 photos, 11 text figs. $2.75.

The Sea and Its Rivers. By Alida Malkus. Doubleday & Company, Inc., Garden City, New York. 1956. 221 pp., 23 drawings by the author. $2.75.

The Open Sea, Its Natural History: *The World of Plankton.* By Alister C. Hardy. Houghton Mifflin Company, Boston. 1956. xv + 335 pp., 142 watercolor drawings by the author, 67 photos, 300 line drawings and maps. $6.50.

The Sun, the Sea, and Tomorrow: *Potential sources of food, energy and minerals from the sea.* By F. G. Walton Smith and Henry Chapin. Charles Scribner's Sons, New York. 1954. xii + 210 pp., 22 text figs. $3.50.

"The great expanses of unexplored sea have had a continual fascination, both attracting and repelling, for men of all countries and of all periods," Philippe Diolé says in preface to **The Gates of the Sea.** "Out of this dangerous, but not unmanageable element of escaping gleams and forms, from this forbidden country, travelled, none the less, by his imagination, as well as by his nets and divers, man has created the empire of his fears and ignorance, the source of his life and of his gods, the ante-room of the great beyond, the habitation of dreams and death, and of the sun." Diolé is poet, philosopher, and mystic among modern skin divers. He looks through the gates of the sea into man's past – the present book stems from an archeological excursion in Sicily and its ambient waters – and into man's future: "the sea is more than just a new country to visit, or the beautiful extension of the land. It is, more importantly, the site of an experience whose consequences can no longer be foreseen. Its exploration involves the opening up of another phase in men's lives, bringing with it a greater illumination of the mind." For Diolé the sea redissolves crystalized elements of man's experience, providing a continuum for the transmission and reintegration of old values and a medium for the generation of new insights. His is a world of ideas and images to which the reader must bring as much creative imagination as he can muster, to be stimulated proportionately.

For everyone stimulated to review man's mythical and historical relations with the sea, a Parisian journalist, Pierre de Latil, and a diving and exploring expert, Jean Rivoire, have searched and digested the source material and presented it for easy but not hasty assimilation in a graphically attractive and properly documented book, **Man and the Underwater World.** Here you will find the ancient fables; the first venturings; the gradual awakening from fantasy as the sea's mysteries yielded to observation; the classical beginnings of diving for sponge, coral, pearl; experiments with submarine devices, from Alexander to Leonardo to Beebe, Piccard and the rest; and of course the modern story of skin diving, with Cousteau and his stout little band of pioneers. Woven in is the history of a science, oceanography, as well as many fascinating curiosities, both scientific and unscientific.

The title is similar, much of the ground – or water – covered is necessarily the same, but James Dugan's **Man Under**

the Sea is actually a quite different book. We quit the study and hit the reporter's beat. Dugan is not so much concerned with antiquities (except in the undersea branch of modern archeology) as with the evolution of modern diving gear, submersibles, and techniques, along with the personalities and exploits of their inventors; with pioneer submariners and their contraptions, like David Bushnell and his impertinent little *Turtle*, "first craft to make an undersea attack in war" — our Revolution, Robert Fulton whose talents as a promoter have never been properly appreciated, Holland, Lake, and the rest; with the men who often risked their lives to learn the physiology of pressure and underwater breathing — Bert, Haldane, and many others; with sunken ship and treasure salvage; with underwater photography, the exploits of "frogmen," sport divers and cave explorers, deepsea oceanography, and a look at the "last frontier" in terms of its resources for our future. Dugan's lively, often breezily journalistic style moves rapidly through a big but never "heavy" book. (He winds up with a table of "Events in Underwater History, 415 B.C. to 1955 and a considerable "Undersea Bibliography.")

On February 15, 1954 Commander Georges Houot and Pierre Willm of the French Navy looked out the porthole of a steel sphere hanging from a huge thin metal envelope filled with gasoline, and saw in their light a sea anemone emerging from the sand. It was the bottom of the Atlantic off Dakar, 13,287 feet down. The Bathyscaphe F.N.R.S.3 had just taken men to the greatest depth ever reached. The event closes Dugan's book. The whole gripping story, with all the background of technical development, Houot and Willm have told in **2000 Fathoms Down** — the complete story Captain Tailliez promised in a closing chapter of *To Hidden Depths* (Dutton, 1954). Here it is, and it's a *true* science thriller.

It takes machines to reach the depths, but the beauty and poetry of sunlit offshore waters are for free-swimming men, the less mechanized the better for both men and sea-dwellers. As F.N.R.S.3 clanks in the ear, so *Moana* is pure poetry. In Tahitian it means **Vastness of the Sea:** a ship, and the story of her sailing, from France to the West Indies to the Galápagos, Marquesas, Tuamotus, Tahiti — Bernard Gorsky's story of four Frenchmen, a 40-foot sailing cutter, and the teeming tropic world beneath her keel. Diving hunters they are, proving they can virtually live by the spear — but the camera is there too, and the awareness of beauty, and curiosity about the ways, even the psychology, of animals. The translator has preserved a quality of prose which I take to reveal a gifted author — the reading is esthetic experience.

Gorsky and his crew killed many fish during their 15,000-mile voyage, but they also learned much of the kind of natural history that enabled Pierre de Latil to write **The Underwater Naturalist.** Skin diving has brought a new order of knowledge of fish ways, it is akin to "bird-watching" on land. In this "first eyewitness natural history of fish" the author has laid many a ghostly fable, like the one about noble Romans throwing slaves to pet moray eels so they could enjoy watching them being torn to shreds and devoured. A generation of skin divers has now studied morays, and mean critters they are. But they don't attack men, any more than most sharks do, and moreover are physically incapable of tearing a man to pieces. Morays and congers, sting-rays and skates, gobies and groupers—de Latil writes of them with authority and with engaging humor.

It is impossible to read of this underwater world without craving to see it yourself. If you are at least 12 and not over 60, and in good health, John Sweeney says in his "how-to" book of **Skin Diving and Exploring Underwater,** the sport may be possible for you. Reading such a book is the first step. It will teach you the psychological as well as the physical requirements, and you will learn all a book can tell you from a highly qualified teacher who can also write extremely well. If you come to the point where you are seriously considering an aqualung, you will find also invaluable a modest little book, **The Art of the Aqualung** by Robert Gruss, a concise handbook of fundamentals which is instructively illustrated.

Salt water covers five-sevenths of the planet, yet how much do most men learn in a lifetime about the sea? Little indeed, compared even with common rudimentary knowledge of land geography and life. To help instill early a relatively infinitesimal but fast growing body of knowledge which is becoming rapidly more important to all of us, Alida Malkus has written **The Sea and Its Rivers** for 12- to 16-year-old understanding, which is to say it will open the gates of the sea for anyone. It is indeed an excellent short course in oceanography in all but the most inclusive sense of the word.

Although the imprint date is 1956, March 3, 1957 is publication date for one of the most notable contributions to sea knowledge in recent years: Alister Hardy's **The Open Sea, Its Natural History: *The World of Plankton*** (a sequel is promised, about fishes and fisheries, and all the larger marine animals).

Why is plankton — the aggregate of minute plants and animals which make the ocean a veritable soup-tureen — so important? It feeds the largest whales; it may some day feed us, to a far greater extent than it does now indirectly through our fisheries. Was Diolé merely poetic, calling the the sea the "habitation . . . of the sun"? Photosynthesis goes on in the sea as it does on land. The flesh we eat is made of grass. Plankton is the grass of the sea. In **The Sun, the Sea, and Tomorrow,** F. G. Walton Smith and Henry Chapin take a long and thoughtful look at this vast harvest of vegetable plankton which feeds animal plankton which feeds fishes which feed man — and weigh the whole against our explosively increasing human population. And they look at the sea's incredible tonnage of minerals in solution, weighing them against our disappearing terrestrial reserves. The sea may indeed be man's last frontier of continuing life on earth. Does not this possibility, however remote it seems, lift the young science of oceanography to a status of towering import?

Whaling, Atlantic and Pacific

"Whale Off!": *The Story of American Shore Whaling.* By Everett J. Edwards and Jeannette Edwards Rattray. Coward-McCann, Inc., New York. 1956. xxiii + 285 pp., 19 photos, endpaper map. Boxed, $10.00.

Whale Hunters Aboard the "Grey Gold." By Chester Scott Howland. The Caxton Printers, Ltd., Caldwell, Idaho. 1957. 140 pp., 24 photos. $4.00.

Of new whaling items, **"Whale Off"** is not quite *"The Story of American Shore Whaling"* but rather largely the personal reminiscences of Captain Joshua Edwards, his son E. J. Edwards, and other whaling men, of the last days of shore whaling on Long Island, and a lively and well documented account it is. The slipcased volume is designed as a handsome gift book for the collector of whaling items.

Son of a whaling captain, the New Bedforder Chester Scott Howland who is known as lecturer and author on American whaling gives us **Whale Hunters Aboard the "Grey Gold"** — true narrative of sperm whaling in the Pacific, being the adventures of one John Baker, an Indian lad adopted by a whaling captain. This is grand adventure reading for modern American boys. D.G.K.

Jungle quests

The word "jungle" is still magic; it sends men from comfort to hardship, from familiar places to the last great unknowns on the land. It sends some to discovery, some to death, all to adventure. Before me is a map of South America, showing a web of waterways, blue lacing the green, from the Guianas to the Mato Grosso – the world's vastest jungle.

Three Tickets to Adventure. By Gerald M. Durrell. The Viking Press, New York. 1955. xiv + 203 pp., map, 10 photos. $3.75.

A young British collecting naturalist made quite a hit with two highly entertaining books about field trips in Africa, *The Overloaded Ark* and *The Bafut Beagles.* This live-wire collector with the lively style, Gerry Durrell, turned up next in British Guiana and turned in *Three Tickets to Adventure*, a book sure to delight his many armchair followers as much as the first two did.

The title is no more fiction than the story: Adventure is a ramshackle port on the Guiana coast, reached from Georgetown via railway and riverboat. Here, and at a ranch-station in the interior grasslands, Durrell and his companions fill sacks and crates with some 500 live animals, birds, and reptiles for British zoos. Their capture and transport fill fast-moving pages of often hilarious adventure and much natural history which will introduce many readers to some curious creatures never heard of before. Along with his flair for the comic situation, Durrell has a keen eye for natural beauty, and a great zest for the adventure of living.

Journey Without Return. By Raymond Maufrais. Thomas Y. Crowell Company, New York. 1954. xi + 235 pp., map, 16 photos. $3.50.

A zest for living at grips with nature on its most savage and elemental terms led a young French hero of the Maquis to Guiana, his supreme adventure, and death. *Journey Without Return* is Raymond Maufrais' diary, found with his rifle, his camera, and other gear, on the Tamouri River, not far from that magnet of so many explorers, the Tumuc Humac range on the border of Brazil. Maufrais tried to reach the mountains afoot and alone, after leaving his last native river guides.

This is a log of almost incredible determination – foolhardiness by ordinary judgment – and sheer guts. The author is sustained by a virtually mystic belief in himself and his power to survive – as he did survive the Occupation of France and paratrooping in Indo-China as well as an earlier expedition to the Mato Grosso in search of wild Indians. In the end, it was hunger. The jungle is not flowing with honey and alive with fresh meat – not always. . . . The last act was the careful leaving of everything, including this remarkable, poignant document, for later recovery, and the starting of a strange voyage – a frail human body, essentials strapped on, manned by nothing but will and faith, swimming and floating downriver towards civilization, a desperate try that failed. Maufrais has never been found, though his father was led by rumors to search these very jungles. . . .

Expedition Tumuc-Humac. By Francis Mazière. Doubleday & Company, Inc., New York. 1955. 249 pp., 30 photos, endpaper maps. $4.00.

Dedicated to Raymond Maufrais, this is the story of another French expedition which was being planned in Paris when word came of the finding of his effects. The news set three almost as youthful explorers – Mazière, ethnologist; Ivanov, cameraman; Darbois, photographer and a woman – on a "rugged pilgrimage in his tracks. His aims were the same as ours: to cross and explore the legendary massif of the Tumuc-Humac."

Cross they did, claiming the first north-south passage by whites of Indian country from the Guiana coast to the Amazon basin. They crossed as a small party had to, by winning the confidence of the Oyanas and their chief Yanamalé, who took them up the Itany and over the divide to Brazilian waters. Again and again the three French had to admit their utter dependence on the good will of the Indians as by canoe and foot they traversed water and land that only Indians knew how to travel and survive on. But how better could they have achieved their geographical and ethnological goals? One is reminded, time and again, of Alain Gheerbrant's *Journey to the Far Amazon.* This is a smaller book, but not necessarily a lesser one. It too has the elements of original discovery—of breaking new ground, both of the map and of the mind.

A certain shadow hung over them. Always on meeting new Indians they asked one question: "Maufrais?" The silent no gave the answer: Maufrais must have died, alone, beyond the help even of forest-wise Indians, victim of the inscrutable forest.

Jungle Quest. By Edward Weyer, Jr. Harper & Brothers, New York. 1955. ix + 198 pp., 42 photos, 3 maps. $3.50.

At about the same time that the young romantic Maufrais was going to his lonely death in Guiana, far across the Amazon basin to the south another one-man expedition was in successful progress. Dr. Edward Weyer, anthropologist and editor of *Natural History,* was taking no little personal risk in calling, alone, on the Chavantes, the notorious tribe of independent red men who have for centuries resisted every effort of white men to establish any sort of relationship with them other than that of reciprocal treachery. But Dr. Weyer is no romantic willing to lose his scalp for glory; he is a mature and experienced scientist and journalist with the twin purposes of adding to the ethnographic record and getting a good big story for his journal.

Actually, only short bits of *Jungle Quest* appeared first in *Natural History.* Readers of that magazine got the preview and should not miss the complete show as given in the book.

And the Chavantes? Bloody, unregenerate murderers? Not at all. Proud people who liked the life of ten thousand years running and determinedly fought off every real or imagined threat to it. Met on the ground of complete trust and mutual respect, they proved admirable in many ways – physically splendid, mentally alert, morally decent despite the tawdry thinking of some whites who wish to confuse decency with the wearing of clothes. Dr. Weyer is not one of these, so could write of his living among them on their own simple terms with both sympathy and objectivity. He found them not only fascinating subjects for study but likable fellow humans.

Lost Trails, Lost Cities. By Col. P. H. Fawcett. From his manuscripts, letters, and other records, selected and arranged by Brian Fawcett. Funk & Wagnalls Company, New York. 1953. xvi + 332 pp., 19 photos, 2 maps. $5.

Over Edward Weyer hung the shadow of Percy Fawcett, the man magnificently obsessed with the idea of fabulous ancient cities, possibly still inhabited, somewhere on the headwaters of the Rio Xingú at the edge of the Mato Grosso, who in 1925 went for the proof he "knew" was there, and vanished. Following the Colonel's accounts of his earlier expeditions, relations of his curious beliefs on the geological and human history of South America, and his last letters to come out of the jungle, his son Brian adds a summary of efforts to find him and his own beliefs regarding the death or survival of his father. D.G.K.

On building a planet

The Earth We Live On: *The Story of Geological Discovery.* By Ruth Moore. Alfred A. Knopf, New York. 1956. xiv + 416 + x (Index) pp., 24 halftone plates, 35 text figs. $6.00.

The many who enjoyed Ruth Moore's *Man, Time, and Fossils* (Knopf, 1953) are finding equal pleasure in *The Earth We Live On,* in which this talented journalist does for the history of geological science what she did in the first book for the story of evolution – namely, to make vivid and exciting a story which reached most of us dimly, if at all, through dull textbooks. From the ancient Greeks to the Lamont Geological Observatory and the first International Geophysical Year, it is the story of man's groping for the essential facts about the planet he was born upon. What shape is it? how big is it? how old is it? and the $64,000-dollar question: how did it begin? Men have always had answers: first from the mythmakers; next from philosophers; finally from scientists – the latter showing perhaps the least tendency to be sure of their answers, being from the beginnings of geology as *science* increasingly aware of the complexity and magnitude of the problems. The computing of the earth's age by means of the rate of breakdown in radioactive elements – a story almost as fresh as last week's paper – makes a dramatic close to a book which began with Hesiod.

Curiously absent from this chronicle is Nicolaus Steno, whose "laws" of 1669 antedate Hutton by more than a century (see p. 19, this issue). Ruth Moore follows convention in accepting the latter as founder of geology, the science.

General Principles of Geology. By J. F. Kirkaldy. Philosophical Library, New York. 1955. 327 pp., 6 halftone plates, numerous text figs. $6.00.

Geology and Ourselves. By F. H. Edmunds. Philosophical Library, New York. 1956. 256 pp., 12 halftone plates, numerous text figs. $10.00.

From England come these companion volumes of basic principles in pure and applied knowledge of the earth, speaking of the origin, composition, and structure of its crustal features and the various shaping and distributing processes which its forms and materials undergo. As his title indicates, Mr. Kirkaldy, reader in geology, University of London, is restating the fundamentals of geological science, under such headings as Physical Geology and Geomorphology, Petrology and Mineralogy, the Composition and Origin of the Earth, Historical Geology, Economic Geology. The latter topic is taken up in full by Mr. Edmunds of the British Geological Survey. He summarizes the bases, then proceeds to relate geology to human life in terms of geological surveys and maps, earth physics and chemistry, water, oil, gas and other fuels, building materials, mining, soils, the effects on the earth of man's concern with all these things, and lastly, the typically British subject of "geology for the amateur." Although these books draw largely on the British Isles for example and illustration, they teach fundamentals of a great science wherever English is read.

Principles of Geomorphology. By William D. Thornbury. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. 1954. ix + 618 pp., about 275 halftones, maps, and block diagrams. $8.00.

The branch of geological science which is mainly concerned with explaining *landscapes* – how the surface of the earth as we see it got that way – owes its major development (its modern development, at least) to several Americans: Powell, Gilbert, Davis, to name the leaders. Professor Thornbury (who acknowledges the helpful criticism of our author A. O. Woodford) has based this new text on their well-tested principles but has at the same time brought matters fully up to date with the inclusion of recent developments and innovations. This is a college text, to be sure, but one which will invite the interested layman or serious amateur who wants to learn the physical facts of the land about him. Especially valuable to the non-professional are the largely new and profuse illustrations.

Realms of Water: *Some Aspects of Its Cycle in Nature.* By P. H. Kuenen. John Wiley & Sons, Inc., New York. Cleaver-Hume Press, Ltd., London. 1955. 327 pp., 16 halftone plates, 190 text figs. $6.50.

Water covers five-sevenths of the globe, and is thus truly the greatest of Earth's realms. It is easy and natural to think of a clear separation of water and terra firma, land and sea – natural but wrong. For the sea extends its sway over the dry land, by invading the atmosphere and thus enveloping the whole planet. There is a complex relationship set up, a delicate mechanism set going since Earth began to take its spherical shape, and gradually evolving into the balanced cycle of water – sea to air to land to sea – which has made possible life as we know it, and which has, through erosion, shaped the land as we see it by constantly wearing away at what tectonic forces build. Obviously one does not understand the nature of the earth until one has grasped the all-encompassing role of water. Professor Kuenen (geology, University of Groningen, Netherlands) has here given us the tool for this necessary understanding. D.G.K.

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LONG RUGGED WEAR

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